

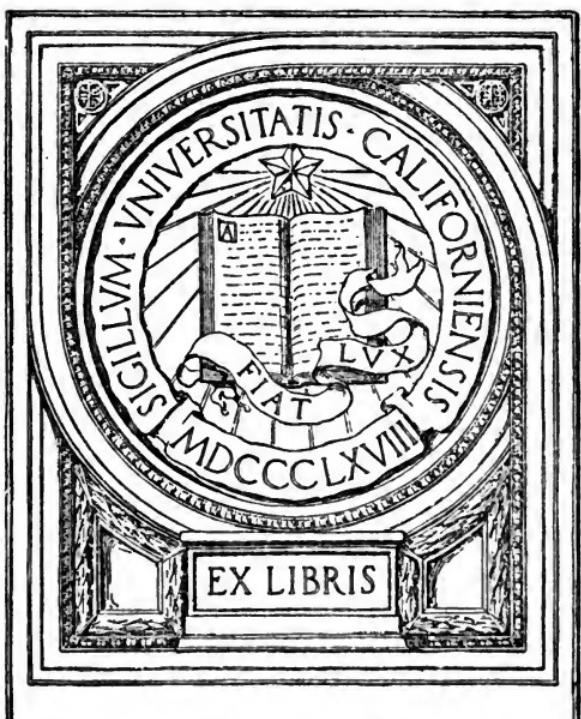
*Principles
on
Efficiency*

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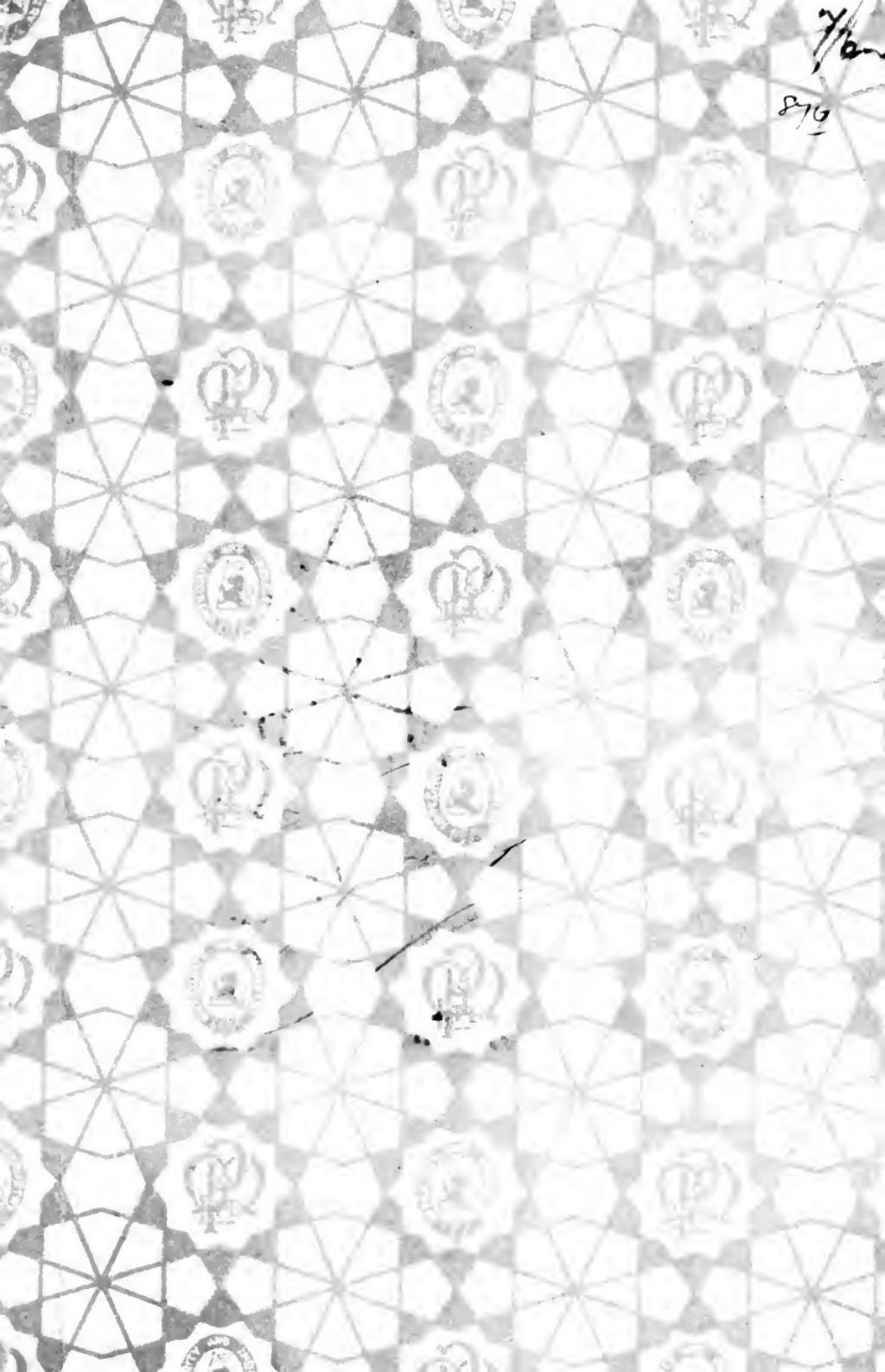


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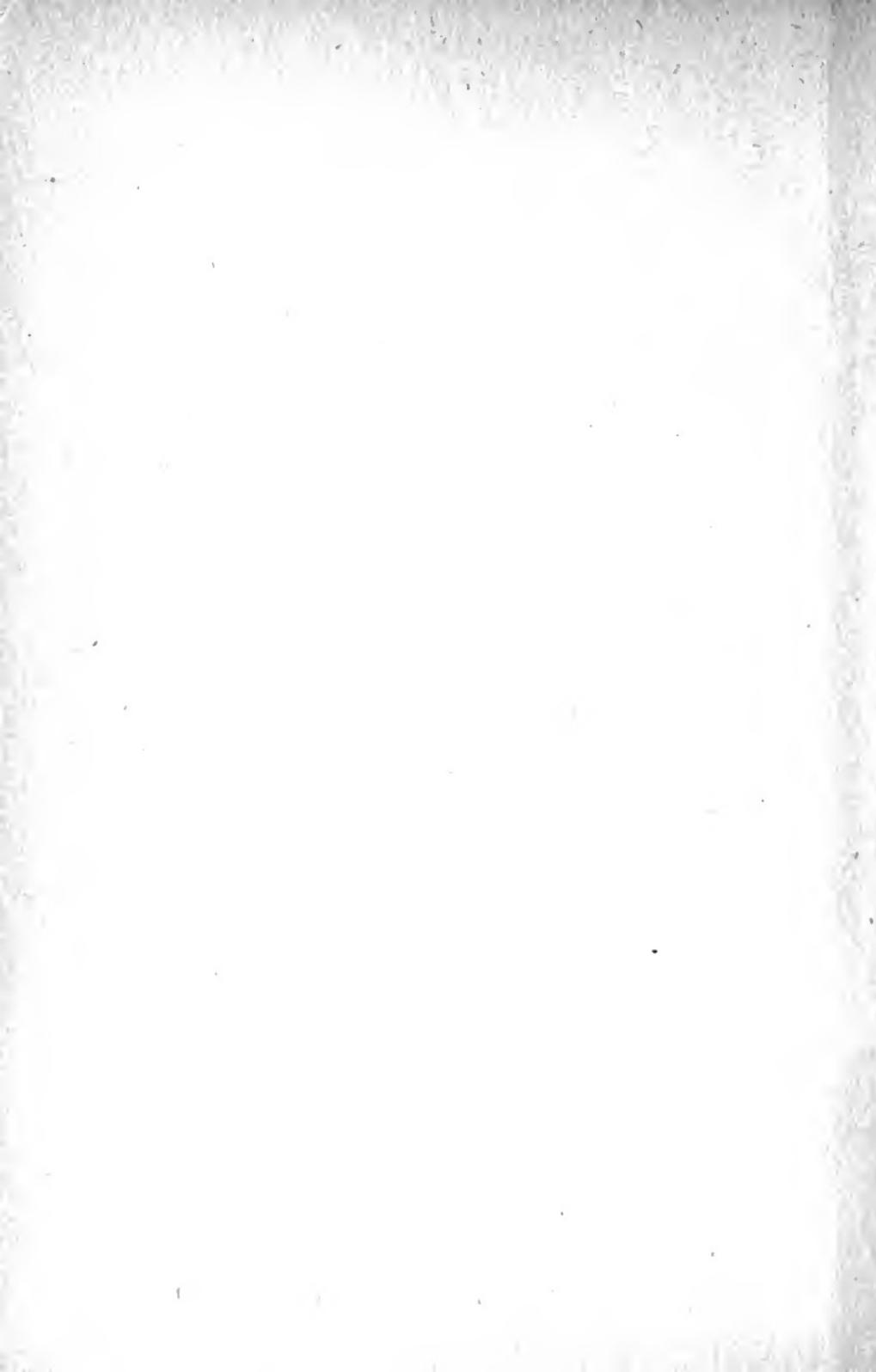


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LECTURES ON EFFICIENCY

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LECTURES ON EFFICIENCY

**UNIVERSITY OF
CALIFORNIA**

**A Series of Six
Lectures delivered**

by

HERBERT N. CASSON

"

To the Staff of

Mather & Platt, Ltd.
MANCHESTER.

1917.

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Almond

FOREWORD

THE Lectures on Efficiency here printed were delivered by Mr. Herbert N. Casson, an undoubted authority on this subject, with a wide experience in two Continents, to the members of our staff of both works and offices at Newton Heath. I hope they will be carefully read and considered by those who heard them, as well as by those who were unable to be present.

Mr. Casson deals with various problems on broad principles, principles which underlie all manufacturing and commercial enterprises. He presents to us facts in connection with our every-day activities which are often ignored or considered unimportant factors of efficiency.

Little or no attempt is made to indicate the precise application of these principles to the details of our own business, that being left to the initiative of each individual member of the staff according to the needs of his particular case.

Most of us are probably aware of the facts—many of them axioms—which Mr. Casson lays down, but there will still remain for all of us new methods of application from which we cannot fail to obtain lasting benefit.

The point is, how can we apply these ideas or how far have we already applied them? If they have failed, were they applied in the right way?

The great importance of the human element is

emphasised throughout, and the vital necessity of the spirit of co-operation for the common good.

What many of us have still to learn is how to organise our daily routine work that it may become more interesting ; the organising side of engineering is a science just as much as the inventive side, and as such can offer vast scope for ingenuity and improvement.

If the lectures result in awakening this feeling, and the creation of a stronger spirit of co-operation between individuals and the various departments of the company, they will have proved a great success, and will, I hope, be the means of ensuring still greater progress for this company to the lasting benefit of the great engineering industry.

L. E. MATHER,
Chairman.

Park Works,
July, 1917.

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LECTURES ON EFFICIENCY

I.

"THE OUTSIDE POINT OF VIEW."

WE are all more teachable these days than we ever were before; at any rate I am, and I imagine you are. We are all learning more these times than we ever have done; there is something new every day, and the world has certainly become a very wonderful place, and there is a great deal of new knowledge. It is almost impossible to keep up with the new things that are being discovered and invented, and a great deal of this new knowledge has not yet got into books.

If you want to become an airman you cannot find out how by any book in the world; you have to listen to lectures, because it is not written down. There are numbers of flying men, and there are classes of young men who are beginning to learn how to fly, and how to operate aeroplanes; but all that knowledge is not contained

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in a single book in the world, so far as I know; it is all in a few men's minds. So with regard to a great deal of other knowledge, we are having not only in this country, but all over France, and even in Russia, Works' Lectures on the principles of manufacturing.

The War has brought us all together; there is no master, no man, no labour, no capital. There was never so little snobbery and so little aristocracy. The peer and costermonger are in the trench fighting together, and one is as good as the other. If the peer got wounded the costermonger fetched him out, and if the costermonger got wounded the peer fetched him out. A burglar got the V.C. the other day; and whether we are burglars, lawyers, or anything else, we are all in the war together, and this general spirit of unity and co-operation has made us more teachable and more willing to find out anything that can help us. It is a new spirit of efficiency that has come into our workshops, as well as into the trenches.

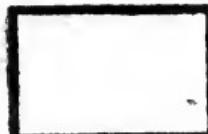
Now, as to the "Outside Point of View," I have got to get that out of the road before we come to the next lecture, the lecture on "Scientific Management." The first thing that you will say, and that everyone says, is "I know all about my business." "How can you teach me my business?" This is a very foolish question. "What does your business consist of?" It is

bigger than you think it is. You only know part of your business; you cannot learn it all yourself.

What a man knows by personal experience is about :



What a man knows by outside experience is about :



What do you know about France by personal experience? How do you know that the world is round? We know by other people's experience. You cannot find out everything yourself. You can only learn a few little details at your daily work; that is not your whole business; that is only a part of your business. No man can learn principles by working at one job, and when you are working at the one job you are blind even to the details. What you see every day you do not see. What you see every day you do not notice.

If a man says: "I know all about my own business" he is ready to die; he is finished; he cannot go amongst ordinary men any more; he knows too much. The only finished man is a dead man. While we live we learn; we have to go on learning, so that no one can say "I know all about my job," because no one does. You put sugar in your coffee; what happens to it? You do not know. We are surrounded by all sorts of things that we do not understand in our homes, and at our jobs and everywhere else.

A job or a piece of work is like a circle divided into two pieces.



Here are the details and here are the principles. If a man learns the job himself and does not read books, or travel, or listen to lectures, he only knows the details. He does not know the principles at all. You learn details by what you do yourself; I could not teach you details. There are no two jobs alike, and so you must learn your own details.

But there is something else besides details in every Works, that is, GENERAL PRINCIPLES, which you cannot learn yourself, because it is a very different thing. There are the two halves of a circle. A Works is like an umbrella, the ribs are the principles, the cloth is the detail; it takes them both. If a man only knows details, he sees his job at the small end; if he only knows principles, he is a theorist and a dreamer, and he cannot do anything at all.

A job is something like this—it consists of How and Why :



You took on a girl worker this morning; you taught her HOW. HOW is easy, but WHY is hard. HOW—that is what the labourer knows, but we ourselves have got to own up most of the time that we are pretty much ignorant of WHY, because WHY requires a knowledge of General Principles.

Now, everyone of us feels this way—and this is a great stumbling block to prevent us from learning more—“My business is unique.” Well, of course, it is; I have never seen one that wasn’t. I have been in a good many places in the last 21 to 22 years, and never saw a place yet that wasn’t unique. Everyone of us thinks himself unique. We all think we are marvellously unique, and the fortune teller tells us all the same things—and gets it right. He says : “There is a difficulty in your way; you are thinking of taking a journey; you have much latent ability; you have three good friends; you have trouble with your relations; sometimes you think you have married into the wrong family,” and so on, so we are all a great deal more common than we think we are. None of us really knows our catalogue number, but we have got one just the same; so that one of the first things that has to be done before we are really teachable is to get the idea into our minds that we are not unique, only partly unique, and that our job is not unique, but only partly unique.

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The average works, so far as I have seen, is about 15 per cent. unique, and 85 per cent. as common as mud. I go into a Soap Factory, and they tell me that soap making is unique; but yesterday I was in a Foundry, and I noticed that it was very similar to a Soap Factory. You can improve almost any Soap Factory by adapting to it the methods of a Foundry. People handle metal more efficiently than they handle soap, because metal is heavy and hot and soap is not, so labour saving methods have come into the metal business, whereas they have not come into the soap business to as great an extent. So the fact is that nothing is as unique as we think it is, and you will find out that at the back of every job there are great general principles.

It is possible for an outsider, who has never seen a works before, to give a kind of instruction that the men in the works cannot get themselves. I was once travelling with an American manufacturer who was ridiculing efficiency and all such things, and the idea that a man could teach him his business. Well, I let him run on for a while. A man is like a barrel; you have got to empty him before you can fill him. If you want to get a man's goodwill get him to tell you the story of his life, and how he failed to be appreciated. "Well," I said to him, "I'll bet you a dinner that if you tell me what your business is I will tell you something about your business in ten

minutes that you never heard before, and that will pay your rent." "I make 'Prams,'" he said. "Folding go-carts" he called them. I had never seen his factory. I do not know anything about Prams, but I went on to show him that he had overlooked the principal things about his business. "Did you ever ask a woman what kind of a pram she wanted?" I asked; "or whether she wanted a pocket in the pram? You have trouble with the woman folding the pram," I continued, "for the reason that no woman has got a mechanical mind. She can only fold a pair of scissors. Lastly, have you ever considered that your boss is a baby? Do you know that a baby is a little live thing that looks and yells, and you have got to give him something to look at? There is nothing on your go-cart for the baby to look at. Make a tassel, red and gold, dangling and spangling, and put it on the front of your go-cart. It will cost you 1s., you sell it for 2s., and the retailer will sell it for 3s. The mother goes in the shop with the baby; the baby sees the tassel, holds out its hands and says 'goo-goo.' The mother is delighted, and says, 'I have got to have this pram.'"

The manufacturer adopted these suggestions, and made 27,000 prams in the following year and 27,000 shillings of extra profit.

Now, that is just an illustration. There is nothing brilliant about it. It was simply telling

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the man a few principles back of his business that he had never stopped to think of at all.

Tod Sloan discovered a new principle in riding a horse. Instead of riding as upright as possible he sprawled on the horse's neck, making his weight as even as possible over the horse, resting on his hands as well as on his legs, and so he won four races in one afternoon. This was not luck, nor because he was lighter, but because he had found a jockey principle which equalised the weight on the horse, and the horse gained a few inches and won.

New details are discovered by workers at their work, but principles are discovered generally by outsiders. Almost every business has been revolutionised more by outsiders than by the people inside the works. Look at the following examples :

Whitney, of the cotton gin, was not in the cotton business. He had never seen a cotton field.

Pasteur, who changed medical science, was not a doctor.

Morse, who gave us the telegraph, was a portrait painter; he was not an electrician.

Bell, who gave us the telephone, did not know anything about electricity. He told me that had he been an electrician he would never have invented the telephone, because he would have thought that telephonic communication was impossible. Bell was a professor of elocution.

Bessemer was not a steel man, and yet he revolutionised the steel business; he knew nothing of steel until he was asked to produce a certain class of cheaper steel. Carnegie, also, knew nothing about steel, yet he made £60,000,000 out of it.

Fulton, who gave us the first steamboat, had nothing to do with the steamboat business; he was an artist.

Cartwright, one of the pioneers in the North country, was a preacher.

Field, who gave us the cable, was a merchant.

Selden, who gave us the first motor patent, was a lawyer.

Eastman, who gave us the "Kodak," was a bank clerk.

Gillette, who gave us the safety razor, had nothing to do with razors; he was a salesman.

Porter, who gave us the first high-speed engine, was a lawyer. He was not in the machinery business at all.

Ingersoll was not a watchmaker. He took a big clock and whittled it down into a watch.

Harriman, the American railway man, was a Stock Exchange broker, and sprang to the top over all the railway men of his generation, because he knew the general principles of transportation.

Who invented the sewing machine? A woman? Certainly not. No woman in the world could have invented it, because no woman would have put the eye in the point. Howe did it, and his

wife probably told him he was a fool to put the eye in the point, but he made a sewing machine. No woman would ever have done it.

Cromwell was an outsider. He was not a King, yet he revolutionised the King business.

Garibaldi was an outsider, yet he unified Italy. Napoleon was as common as any of us. He had nothing to do with any of the Bourbons, yet he put up kings and pulled them down.

Joffre, son of a cooper, learned to make barrels. Now he is one of the principal generals in France.

Columbus discovered America. Why? Because he was *not* a sailor. All the sailors believed that if they sailed west towards sunset their vessel would go to Hell. Columbus did not know about this, so he sailed towards Hell and found the States.

So, you see, these are very remarkable facts. It should make us all teachable when we remember that in the history of inventions the greatest inventions have come into the business from outside.

It stands to reason that a man may be as ignorant of his own business in many things as he is of his own body. If anything belongs to you it is your body, but what do you know about it?

I asked a shoe manufacturer the other day how many bones there were in a human foot. He did not know. No wonder we have corns and bunions when these men do not study the foot.

These boot manufacturers begin to make boots before they study the feet. We usually start a thing before we are ready to do it.

If you have a pain in your body you go to a doctor. He asks you what is the matter. You do not know. You go to an outsider whom you have never seen before, perhaps, and who has never seen you. He does not know your habits, or he could perhaps tell you more. The reason why we get so little from the doctor is that we never tell him enough. It may be the truth, but it is not the whole truth. You run to the doctor because he knows the principles of your body.

How many bones are there in the wrist? How many pairs of ribs have we?

What happens to the food we eat? How does the food turn into blood? How many gallons of blood does our body contain? The most wonderful pump in the world is the pump of the heart, there is a pump for you which often lasts for 80 years without repair.

How much salt is there in a man's body? There are six teaspoonfuls of salt in the average man. He has enough iron in him to make a 10in. nail. We do not know about our own eye, our own teeth, and the marvellous salivary glands of the mouth. We have 32 teeth, and we should give each tooth a chew to assist the process of digestion. Now, does it not follow that if we are so ignorant

about our own bodies that we may be oblivious of many facts with regard to our business?

Take the business of making cigars. What is the main thing? Temperature. You cannot make a good cigar in a northern climate. You must go to such places as Florida or Cuba, otherwise the outer and covering leaf will break and crack, and your cigar is gone. So temperature is the principle back of cigar-making.

If a man is running a lathe he has the principle of speed. How many machines are running at exactly the right speed?

Take a shovel. There is a right way to shovel—to let the swing of the body throw the weight on the shovel and force it into the coal. To lift 21lbs. of coal on the shovel at once is the correct amount. If a man is lifting 28lbs. he tires too soon, if he is lifting 16lbs. he is not lifting enough. The main principle is that he is not lifting the coal, but lifting himself when he shovels, because when he stoops down he is lifting 1cwt. of himself up, as well as 21lbs. of coal.

A manufacturer sells all his output to one customer. Well, what happens to him? He goes under. No manufacturer can afford to have only one customer, because then he ceases to be independent, and pretty soon is swallowed up by his one customer.

Take the basic principle back of manufacturing—that there is nothing so cheap as machinery and

nothing so expensive as labour. Take the poorest man you have. You pay him 4s. a day, that is the interest on £1,200; so that if you do without this man you would have £1,200 to spend on machines. Many manufacturers think that it does not matter how many men they have at 4s. per day. They do not see that every man represents £1,200 of capital upon which they might be paying interest. There is nothing so cheap as interest, and nothing so dear as wages—there is the principle back of manufacturing.

I met a foreman the other day who said : "I have always been over 100 men." He would not work if he only had 85. He had never stopped to think of the main principle of manufacturing. He was measuring his own position in the company by the number of his men ; when he put on 10 men he was 10 per cent. bigger. The more men he had the greater he became, in his own opinion.

Take the retail business. A man starts with a little retail shop, and he does not think of retail principles. Some uncle has left him £200, so he starts a little cigar shop. The first morning in come five of his chums, and each one buys a cigar. He thinks he is doing well, so he takes the sixth cigar and smokes it himself. That was his profit, but he did not think of that. He sells five and smokes one, so he gets nothing ; all the money for the five goes to the manufacturer. He only

makes a profit on every sixth sale, but he smokes the sixth cigar, and he makes no profit at all.

Take advertising. The main principle back of that is that an advertisement is divided into three parts :

- (1) Attention.
- (2) Desire.
- (3) Action.

The upper part is to attract the eye of the public. The second part is to describe the goods. The third is to give some special offer with the name of the firm at the bottom. One is the bait, one is the string, and one is the hook. Advertising is fishing.

The investment banker has a general principle—“Buy when the crowd sells, and sell when the crowd buys.” If you can do that you will be rich, but you cannot do it. The banker, who is the strongest and ablest banker in London, is the man who can *stand firm when the crowd stampedes*.

Take manufacturing. Manufacturing is not business until you both make and sell. Business is exchange. I make a thing, you make a thing, we exchange it—that is business. I make a thing and keep it—that is not business. Manufacturing is business only when you exchange and the money comes in. So you have to think of yourselves, and also of the other people. If you make things only to please yourself, that is not business. You have got to be thinking of the other man all the while,

and ask yourselves who in these works represents him. Who represents the public? You must get the public's point of view.

In business there must be two points of view, otherwise the business would not go on. Business has three elements—the buyer, the seller, and the commodity. So it means there are three kinds of ability—the manufacturer, the salesman, and the financier. Wherever any business has grown to be widely known, as your own business has, you will always find that it has had these three principles well marked out. It has had men who know how to manufacture, and men who know how to sell, and men who know how to use the bank. Business is a co-operative thing, and it can only grow up when it has the three different elements—the making, the selling, and the financing.

Another principle of manufacturing is that price is total cost plus profit. You must make a profit. Civil Service is not business—it is often bankruptcy. The telegraph has been losing a million pounds regularly for the last 30 years—it is a bankruptcy rather than a business.

Price depends not only upon manufacturing costs. Price depends upon a great many things. It depends upon opportunity, it depends upon competition, it depends upon conscience, it depends upon emergency, it depends upon the customer, and how much he has got.

Oil paintings are dear because there is only one of each kind in existence. You pay £1,000 for an article which does not cost £10 in material. A buyer is a man who wants the article more than the price. A man at the front paid £9 for a copy of the *Times*, because he wanted the news from the Homeland; price does not matter as much as we think it does. Price is a haphazard and mixed-up sort of thing.

There is another manufacturing principle that time increases cost. Every minute that goes on the job puts money on it; the whole work depends on minutes and seconds. If you have 3,000 workers, and if they lose one minute out of every working hour, they will lose 50 days a day. We have to think of that when we have thousands to think of—3,000 times a minute, that is our unit. We have to multiply every minute lost by the total number of workers. Time is a tremendous thing.

Total cost equals first cost plus maintenance cost; that is another principle which we find out when we buy a motor or a house, and we find it out when we get married. We find that good things are the cheapest. You buy a suit of clothes for £3, which lasts you two years, that costs you a penny per day; you buy another which costs you 30s., and which lasts you six months—it costs you 1½d. per day—50 per cent. more. The first cost is not the main cost.

Greater risk compels greater profit. Every time you make a new thing you have got to put on so much more to cover the risk. For instance, if I were selling sugar I would be content with 5 per cent., but if I have a millinery business, and am selling trimmed hats, I would want 200 per cent. Why? Because the hats change every three months, and I must get rid of my hats, as all I have left on my hands are scrap; so I have got to have 200 per cent. The profit must be in proportion to the element of risk.

Values are immediate or deferred—that is a vital principle. There is the tragedy of a forced sale. A man says, "How much is your house worth?" You cannot tell him; no man knows. Suppose it was sold to-morrow it would be worth hardly anything. Suppose you sold it to the right man, and it suited him exactly, it would bring a very high price.

Averages tell results. How often you find that a rather dull and slow man will produce more than a brilliant fellow, because a brilliant fellow will work perfectly for three hours and make a record, and then he will slack and think of his record for a couple of days. There is the disappointment of every annual report. It reveals the low average of the year.

So, as you can see, there are general principles that run through all business, just as they run through nature. Business is not a crazy patch-

work; manufacturing is not an "Alice in Wonderland" mystery. The same God who made Nature made Business, and we do not think of it; and just as you go into a forest and notice how different the trees and the flowers are, yet there is no one thing in that forest that has not got its name and its nature, and any naturalist will tell you exactly what it is. That is SCIENCE.

In every works there are great general principles of efficiency and organisation, and planning and standardisation, and human nature, and we shall study these one by one in the following lectures.

II.

"EFFICIENCY—WHAT IT IS—AND HOW TO APPLY IT."

We might just as well begin with the definition of efficiency. Efficiency is a new word; we use it in a new sense. Efficiency is a higher percentage of result, secured by applying what is called the "scientific method" to manufacturing.

Efficiency is not what it used to be ten years ago; if a man was naturally clever with his hands and quick with his head, and did very well in any work that he had to do, he was said to be efficient, and that is a good enough general meaning of the word; but efficiency has now become really a profession. It has become a very definite thing. Just as flying has become a profession, just as the submarine business has become a profession, so has efficiency become a technique; we will get into it presently.

This thing called "efficiency" or "scientific management" has its technique, just as much as dentistry or printing. Of course, a boy can buy one fount of type, and get a little press, and print cards while you wait, and you will be sorry you waited. The boy calls himself a printer, but he is not a printer because he says he is. So can

efficiency begin in a very small way, but it has been built up until it is to-day in many respects a new knowledge, a new point of view, a new method, and in many respects a really new profession.

Efficiency is not system. We used to think it was 15 years ago. You will remember 15 years ago there was a great deal of system in the business world. We had our filing systems, where we put our letters and never could find them. We had all manner of systems; offices were flooded with systems, and now we have found out that a system may be a very bad thing as well as a very good thing. System in itself is not necessarily a good thing at all; it depends on how much you know about your job before you put in your system. You can do the wrong thing systematically, can't you? A man can have bad habits and lose his health systematically, and he can go systematically to the bad. I could name some hotels in Manchester which have gone systematically to the bad for the last ten years—you will know them. Many a business has gone systematically wrong, so system in itself is not necessarily efficiency, and not necessarily a good thing—it depends on how efficiently the system was created.

We used to think that the more clerks we had—the more rubber stamps we had, etc.—the better the system. Now, we have found out what a lot of tomfoolery there is in the matter of rubber

stamps. It is better always to have one live man with his eyes open than all the rubber stamps in the world.

Efficiency does not mean energy. It does not mean speeding up; it means just the opposite. There is always too much energy; we all use too much. We all walk about too much. It is not that we should use more energy; we use too much now, but we don't plan it enough; we do not get enough out of it. Efficiency is the very reverse of speeding-up, rushing, and getting frantic. I see a man working slowly, steadily, not losing a motion, his eye on the job, not hurrying; that fellow is all right. But I see another man. What does he do? He is running round the shop with a chisel in his hand; he has nothing to do. A man will do that for an hour. Now, that is all energy—all walking is waste—you never earned a penny in your life with your boots, because you are not a postman. All hurrying, rushing here and there, is what you see in many shops. When you see 100 men with 15 running about that is 85 per cent. efficiency.

I know some managers who will point to men running hither and thither, and they say, "Look at those busy fellows," but they are only earning money for a shoe factory, not for this factory; and it is often thought that haste, hurry, and rush mean more efficiency. They do not. The quieter and the easier you run a works the more you do,

and we do not want to add to the energy, but rather to take away from the energy and to increase what is done.

Efficiency is not organisation. Organisation is a good thing or a bad thing, just in proportion to the results obtained. In Civil Service, everything is sacrificed to organisation, everything is sacrificed to accuracy. Results do not count. Now, in a practical business place, accuracy is not the only thing; the main thing is the results, so that organisation does not necessarily mean efficiency.

Efficiency is not economy; sometimes it is and sometimes it isn't. Generally we economise too much; we would make more if we spent more. If we put in another machine instead of having 17 men and paying 17 men's wages, that would be more efficient.

Efficiency is not accountancy; sometimes the accountant thinks it is. You can only get a diagnosis from your accountant; you can never get a remedy, and you should never take a remedy given you by an accountant. He can only tell you what you have got, and what you have done; he can never tell you what you ought to have. Every accountant's report is a post-mortem; it is the record that shows what you have done in the past, but that itself is only a basis for what we call efficiency.

Efficiency is not commonsense. Suppose a man comes to you for work. You ask him what is his experience, and he replies, "I have got commonsense." You would not under these conditions take him on for anything. Commonsense is like the salt at the meal; it is like the salt on the meat. It is flavour rather than food. Of course, everybody has to have commonsense, or he cannot climb up at all. Commonsense alone would never bring you anywhere so far as technique is concerned. It is very important to make it clear that you have got to have skill, study, and knowledge, as well as commonsense.

Efficiency is not Americanism. You cannot take a thing from the States and bring it over here, because our nature is a good deal different over here from what it is there. You cannot take a thing from a foreign country and transplant it altogether; but a general idea can be taken over and can be adapted. We have got American machines in our works, but we are not Americans because we use Cincinnati machines. There are all over the States machines made in Manchester, but Americans do not think they are English because they use Manchester machines; and so it is with efficiency. You cannot put the stamp of any nation upon it.

Efficiency does not mean everything new against everything old. You cannot put the new against the old, because that is folly. There are

plenty of new things which ought to be thrown out of the window, and there are plenty of old things we ought to keep and respect. You cannot put new men against old men. Each has his peculiar virtues. I like to think that, though I am getting to be about 50 years of age and cannot jump over a gate, I know a great deal more than I did years ago. I have got certain things that I did not have when I was 20 years younger. It is always the prime of life, I believe, and you never can say that the young are superior to the old, or the old superior to the new, in men, machines, methods, or anything else.

Efficiency is not slave driving. That is what many workers think. That is what many Labour leaders think, and there are plenty of reasons why they think so. You cannot blame them for the suspicion. But efficiency is not slave driving, because it holds, first of all, that you must establish right relations between the workers and the management, otherwise you cannot have any efficiency at all. If you have a crowd of sullen, hostile workers, hating the management, grudging to go to work, damning the company in their hearts, neither I nor any man on earth or angel from heaven can put any efficiency in the works.

The other day a man in a London club said : "I want you to come to my place to see if you cannot get more work out of my men." I said :

" Better get the work *into* them first, nothing comes out unless it is in. The first thing is to get the work and the goodwill and the skill into your men, and you cannot keep it from coming out when once it is in." Slave driving, cutting the piece-rate, speeding up—that is not efficiency at all. It is a sort of make-believe efficiency—it is not the real thing. It is exactly the opposite of what we call efficiency. Certainly we do not want to make men less than they are. Efficiency is applying the methods of science to business problems. So we must see what we mean by the methods of science. Science means *basing opinions on facts*.

ZOOLOGY.—If I pick up a bone in a jungle of Africa, and I bring it to London, I can give it to a scientist, and he will tell me the animal it was in, and where I found it—that is zoology.

GEOLOGY.—I pick up a rock on the banks of a river in Siberia, I bring it to a scientist in Manchester, and he tells me what sort of rock it is, gives it a Latin name, classifies it, and tells me all about that rock—that is geology.

ASTRONOMY.—I find on my calendar in my office that the sun will rise to-morrow morning at such a time to the minute, and set at a given time. A year ago they could tell you exactly when the sun would rise and when the sun would set—no guess-work. We can predict an eclipse. We can tell

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that in 15 years from to-day, at 4-30 p.m., there will be an eclipse of the moon—that is astronomy.

We are insects on this tiny earth whirling three ways through space; yet we can tell to a minute when the light of the sun comes over the edge of our little earth—that is science. We can tell the weight of the sun, we know what is in it, we know the habits and methods of the stars. But we do not know at what speed to run a lathe, or we do not know the angle of the cutting tool, or we are not sure as to the nature of the steel, or as to this or that, so that while science is largely based on facts, manufacturing is largely based on habits and opinions. The motto of many a works is " You never can tell."

Take a science that is half-way between astronomy and manufacturing. Take chemistry, which is not a complete science. We do not even know how many elements there are. We do not know what radium is. Even the atomic theory is being doubted, because we find out that one element breaks down into another. Gold may break down into copper, radium may give off heat for thousands of years before there is any destruction of the radium itself; so that chemistry is a little bit of accurate knowledge with guess-work all around it. Little by little scientists are enlarging this, discovering and increasing the amount of real knowledge that they know. Here is where efficiency comes in.

The success of science leads us to ask ourselves : Is it possible to take some departments of manufacturing and clear them up? Is it possible to take the methods by which we build up science and to build up our factories and our shops? You say, "Well, I did not know that, or I would have done it before." The scientist knows nothing about manufacturing, never knows anything of its problems, does not appreciate it, and so he has kept his methods to himself. The business man, on the other hand, knows nothing about science. The scientist has had time to investigate, while the business man has no time to investigate. The scientist is on a salary, while a worker is on piece-work and measured by output. The head of the department is measured by output, too, and he has no time for investigation. You have got your orders, you have got to produce, and the man who has to produce has no time to work out problems as the scientist does. The result is that there has been a line drawn between business on the one side, and science on the other, and efficiency means this: the carrying over of the scientific method into the world of business. We are finding out that a great many things can be done.

Efficiency is a new thing. It won't make a new heaven on earth, but it will come in very likely as steam came in, making tremendous changes with regard to our methods of production. We find out that to go by facts is better than to go by

opinions. There is nothing so profitable as facts, and there is nothing so dangerous as opinions. Yet you will find in the average shop, as you go about it and ask questions, that you will usually be given opinions instead of facts. I never saw the shop yet in any country that was not practically packed with opinions, so we have to study our opinions and see if we have got facts behind them. If you have not got facts back of your opinions, your opinions are a roof without a house—useless. If you have got facts underneath your opinions, then you have got the complete structure.

You see we are in too much of a hurry in the manufacturing world. We have not got time—the scientist has. Darwin spent eight years studying earth worms. If we had spent eight years studying belts they would not be so tight or slack, and we could prevent five-sixths of the breakages if we had only studied belts; but we have no time.

We have in every shop a few places where we have that exact knowledge, but all through the shop we have this: "You never can tell." We have things that have not been studied out, things that have not been investigated, and conditions that have not been standardised. We leave it to the man himself, we leave it to each individual man.

There is one right way to do everything, and many wrong ways. You never can find a right

way by chance. Suppose you have four dice, how many chances are there that you will throw four sixes? There is only one chance out of about 1,300 that you will throw four sixes with four dice. We never can trust to the chance cleverness of the workman to happen on the right thing, we never find the right thing without working it out by facts.

The first man who worked out efficiency methods was a man called Taylor. He was the first pioneer beyond all question. There was nobody before him, although his methods have been modified in recent years.

Taylor was a foreman in a machine shop in a steel works. He was very fond of science, and read books on science at night. It occurred to him that, just as the scientist studied thousands of insects before he formed an opinion on those insects, and as a scientist gathered exact knowledge, so a foreman should study the facts of his own department. The first thing that he did was to ask each of his workmen, "Is this machine running at the right speed?" In every case the man was surprised, "Well, I suppose so; it's the way I found it." Taylor soon found out that there was no such thing as exact knowledge with regard to the speed of any machine in his department.

Then he went down the line again. "Is this the right angle for the cutting tool?" "Well,

I suppose so, Mr. Taylor; this is the way we have always done." But not one of his men was sure. Then Taylor asked a third question : " Is the right steel in that tool?" " Well, this is what the tool boss gave me." Nobody knew. So Taylor found out for himself, that with regard to the three most important things in his department, nobody knew. It was all opinion, and not facts.

That is the way efficiency was born. Taylor found out that he did not know the exact facts about the work that was going on, and neither did anybody else know. It was largely tradition passed on from man to man. Bill learnt it from Joe, Joe learnt it from Tom, Tom learnt it from George, and George never knew it. So there you are—the thing goes on from man to man, father to son, and nobody really ever knew the exact facts. This condition is in every shop, and in all sorts of places. But Taylor did not believe in such methods. He said : " It will pay me to get the exact facts." He made experiments, and got every machine running at the right speed; but it took him several years to get the right angle, and to get the right steel took a good many years more. Altogether he experimented for 26 years in the art of cutting metals. He found out there was so much to be known on that one thing, and out of those experiments what is called " Scientific Management " was born. Output went up,

energy went down, cost went down, wages and profits went up, everything was changed for the better, and out of those changes the general theory of efficiency, as we have it to-day, originated.

The next man, Emerson, had nothing to do with Taylor. He came in from somewhere else. He was a professor in the Nebraska University. He was educated in London, Paris, Germany, Japan, and the States. His father was a great traveller, and as a boy he was taken here and there to different countries. He had a natural bent for mechanics, and he studied engineering in five different countries. Then he went out hunting for gold on the Yukon. He was out for several years. Then he came back and became a professor in a university, and then through a fortunate accident he suddenly had a factory thrown on his hands, and he became a works' manager. He came into that factory with a very general experience. He had studied Darwin, Huxley, and other scientists, and he was wondering whether scientific methods could be applied to manufacturing. He greatly improved that factory. He lifted things up all along the line, and he did so well that another factory called him in. Presently he was in great demand. He became so successful that he was taken on for three years by the Santa Fe Railway to cut down the time taken in repairing locomotives. He saved an immense amount of expense with regard to the operation of

locomotives, he standardised the repairs, and worked out so many reforms that the Santa Fe Railroad became probably the most efficient railway in the States.

The next efficiency pioneer, Gilbreth, was a contractor for brickwork. He heard Taylor make a speech (Taylor was a poor speaker, but he spoke occasionally at the Engineers' Club). Gilbreth went to Taylor after the lecture and said, "That's all right for engineering and machine shops, but how would you apply it to bricklaying?" Taylor said, "I do not know until I get the facts." Gilbreth said, "It cannot be done; absolutely absurd; we have been laying bricks for 10,000 years, so how can you teach us to lay them better?" They went out together, and began to watch some bricklayers, they saw and studied the motion of bricklaying, and found that average bricklayer, stooping down to pick up a 7lb. brick, incidentally picked up 1cwt. of himself. The bricklayer was stooping down 700 times a day, 700 times 1cwt. is about 35 tons; so he was picking up 35 tons of himself, and Taylor said, "You do not want the bricklayer to pick up himself. . . ."

Gilbreth found out that the average bricklayer took 18 motions to a brick. By motion study he reduced the number of motions per brick from 18 to 5, and increased the number of bricks laid from 700 to 3,200 per day. He had one labourer to wait on every six bricklayers, the bricks here,

mortar there, all handy, and the bricklayers were as fresh as daisies after laying the bricks. This system, however, has not had the success that it might have had, owing to the fact that the Bricklayers' Trade Union would not adopt it, and that is why reinforced concrete has come so much to the fore. Bricklaying was so expensive that it has been gradually ousted out.

There has never been a single trade studied but what it was found to be partly opinions and partly facts—very largely opinions. In many cases it was found to be largely tradition, largely little groups of facts in the middle of uncertainty. The scientific method comes into a trade, and here is what it does. It is not that an expert comes in with extraordinary knowledge and looks at the machine and says, "Change it, improve it." No such thing. The scientific method is the method of a plodder, it is not a brilliant thing. A man who wants to get on must be patient. The great thing in the world is patience. The brilliant man never gets very far. Very few brilliant men have succeeded, for a brilliant man is usually short-winded and cannot go the whole 150 yards, because he has not got his second wind. The man who has the second wind, and sometimes a third and a fourth, is the man who wins—the efficiency man.

There is no magic way with efficiency—"presto-change!" The real scientific method

is this: go up to a machine and look at it, for heaven's sake LOOK at it, for the first time SEE it. What you see every day you do not see. You have been working it for ten years, and you have not seen it for eight. How many buttons have you got on your coat sleeve? You don't know, because you see your coat every day. Could you draw a horse's hind legs? You never notice these things because you see them every day. The eye is a 2in. telephone system that runs from the eye ball to the brain, and when the eye has seen the same thing thousands of times it stops sending the picture to the brain. That is why we do not notice what we see every day. Very often a father does not know the common facts about his own children, and a neighbour comes in and tells the father something he never knew. The father does not notice his son. He takes him for granted. He never studies him. He never opens his eyes and looks at him. That is the tragedy of fatherhood. He looks at him and says, "What is this that I am the father of?" This is a fact of eyesight, it is a fact of brain sight, and so the first thing we have to do in efficiency is to really LOOK at a job, see it, study it, investigate it, THINK ABOUT IT.

Thought consists of two things—you notice, you compare. That is thought; that is the only way that anybody can think. To notice and compare, that is the process of thought. So we

must notice the job, think of it, and put down the facts exactly as they are, and then build up the right technique by using these facts.

When you apply efficiency to a job you must not take it for granted that you know anything about it. Try it on one machine or one corner of your department to-morrow. Just look at 20 square feet and say to yourself, "I never saw this before, what is here?" You will be surprised. Look at it, see it, begin to gather the facts, and you will get a little harvest out of every 20 square feet if you apply this scientific method.

Investigate, take it for granted that you don't know, gather the facts, analyse the facts, plan the facts, eliminate the useless ones, and standardise as many as you can. It is not an easy thing, but as the result of it you will get to a large extent what we call "Exact Manufacturing."

To put it in a general way, it is the scientific method against the traditional method. Every trade and every shop gathers rust and dust and cobwebs, and falls into confusion and chaos always. Did you ever see a garden weed itself? Never. Here is the tragedy of this human life of ours. Every human thing sags unless you hold it up. It goes down, nothing grows up magnificently of itself. No job ever built itself, no job ever made itself, and when you leave it alone it sags, just as a worker sags every day.

Every night we go to bed and sleep repairs us. The bed is the repair shop. When we shut our eyes and go to sleep we are repaired. The body is a workshop—the most marvellous workshop in the world—a self-repairing workshop, with millions of cells—5,000,000,000 cells in the brain alone. We sag in the day time, and with food and sleep and recreation we go up. Energy in, energy out. Life is a reciprocating process, and you must keep the in and out even. In the same way you have to continually investigate, study, look, watch what is being done, otherwise there comes a sag in your manufacturing, and your efficiency decreases. Efficiency is the upward thrust.

Sound efficiency begins with *why—why—why*. It starts with the worthlessness of mere opinions. An opinion of itself is worth absolutely nothing at all.

Recently I went to a machine. I asked the girl who was working the machine a question. She gave an opinion, then someone else gave an opinion, and the foreman gave another. That was three opinions in five minutes, and nobody was right.

Instead of saying glibly, "This is the reason," better find out what is the reason. Put it to yourself, "Do I know?" In most cases you will find out you do *not*. We have to WHY every job.

Why is this? Why is that? Then we begin to see the difference between facts and beliefs.

Efficiency means the bringing in of more life and more thought into the job. There is an eternal battle between life and decay. This wooden desk is rotting while it stands here, this paper is rotting while I hold it in my hand. My hair is turning grey, and if I had a hairometer I could tell at what rate of speed and acceleration it is turning grey, and how much greyer it gets every day. We are changing—every particle in your body is changed every seven years. There is no part of your body which does not change. We are all changing—changing. Everything is going to decay all about us, everywhere the iron is rusting, everywhere there is the pull, the sag, the decay of every single thing on this earth. Now, as against this sag, you and I as living creatures have to resist it. We must resist this inertia. That is what Life is for.

We have to go against inertia with conscious intelligence and energy and vitality. A works sags. So does a department, so does a job, so does a man, so does everything, unless you resist by deliberate gathering of the facts, and building them up into a better technique. The most efficient shop in the world is only kept there by the constant fighting of the managers in it to keep it from sagging. It is a most tragic battle that is always going on. Nobody has ever written

about the battles in our machine shops—the battles where we have to put together human nature and steel, and make all sorts of things. No one has appreciated the difficulties that we have; but this battle is going on, and efficiency means that we shall bring into manufacturing the exact methods which have accomplished such wonderful results in the world of science.

We have above our heads this electric lighting—this tamed lightning that flashes obediently on a wire at the touch of a girl's finger. There is a result of science, the study of a patient man who took nothing for granted, but experimented until he found out this marvel of taming the lightning. So we also can accomplish much in our daily work by patience, perseverance, investigation. We are asking ourselves here in this world of industry: can we not go further than we do in open-mindedness, in research, in gathering the facts, in holding our opinions a little more lightly, and in respecting as the most powerful thing in the world—the TRUTH?

III.

"PRINCIPLES OF ORGANISATION."

Organisation is a subject that we have not been specially good at in a business sense. It is a very strange fact that we have built up the greatest organisation in the world beside which everything else is small. We have built up the British Empire, and that is an organisation—it is the greatest organisation that the human race has ever constructed. What Cæsar did was child's play to it—what Napoleon built up was a mere trifle—what Alexander the Great, Xerxes, Darius, and all those old conquerors of ancient times did was as nothing compared with the British Empire. We have a quarter of the land; we have all the ocean, and yet we have a little bit of an island here that is so small that when we look over the map for it we cannot find it because it is under our thumb. This little bit of an island has built up this enormous Empire—27 per cent. of the human race.

On the other hand, in business, we have not built up the largest companies, and if you want to study company organisation you have to go elsewhere. You cannot study it in Great Britain; if you want to get the facts as to business organisation you have

to go outside this island. We have not yet found out how to organise companies. We have nothing here to compare with some of the great companies of the States; and we can hardly comprehend how tremendous they have become. For instance, here is the Annual Report of the United States Steel Corporation; there is nothing in this country that compares with it in any sense whatever. It is almost as impossible for us to understand this as it is for an American to understand the British Empire, and I never found an American yet who understood what the British Empire was. It is impossible for Americans to comprehend that a single one of our Colonies is as large as the United States. I do not understand why this is, and I am only mentioning it to call attention to this fact—that we can build Empires better than we can build companies.

Perhaps the reason for it is largely this, that the United States is made up of all sorts and conditions of people, and if they had not studied organisation more than any other nation they never could have stuck their 48 States together. In an American Company you may have 15 to 20 nationalities. When it publishes a book of rules, it publishes these rules in 15 to 20 languages. Here in England we have one language; we are all alike; we are all of the same breed; we are all brought up with the same opinions; we know the same facts; we make the same mistakes; we are all the same sort—

whereas in the States they have 15 languages, and their difficulties in putting together different sorts of people led them to study organisation more than we have ever done. We have depended upon the individual man, while they learned how to organise companies.

Here, our old way has been pretty much personal leadership. Almost every company we have was built up around one strong man with initiative, with ideas, with brain, with force. He gathered capital—earned it first, borrowed it later, and with capability and intelligence, he gathered men about him. Presently his little factory became two factories, and the business expanded until by and by all the world knows the name of that company which was built up around one man's personality. Count over all the companies in Manchester—you will fetch each one back to a Man. We have spun them around one man because we are the most individualistic people in the world. We are a nation composed of separate units; every man feels as though he were competent and self-sufficient, and that prevents us from organising as perfectly as we should.

I do not prefer the American way. I would sooner continue as we are; but it is a good thing for us to know our drawbacks and failings; to correct them as far as we can; and when we build up everything around an individual we should also spend some time in studying the principles of

organisation. Otherwise what do we do? We kill the clever man by throwing the whole burden on him.

Here is the central man in the whole company—what happens to him? He dies 15 years too soon. We break down our man, because the whole business gets thrown on his back and he struggles to carry it and it crushes him. A man can only handle a limited amount personally. The time has come when the head of the business must learn how to put work away from him, and that is what he does not know how to do. We have not learnt how to push work from us by organising, by putting it on others and building up an organisation instead of doing the work ourselves. Personally, we prefer to do it ourselves. Many a business man's one trouble is that he cannot take the factory home with him at night and place it under the bed. Then he could look in the middle of the night and see if it was there. He wonders how it gets through the night without him.

The main thing is not to be indispensable, but to be useful to the company. The thing is to organise the department so that if he should swallow a fish-bone the company can still carry on. That is what a company is—a device to make a business perpetual. The company has no death, although you and I live and die. Your fathers, perhaps, worked here; you come in their shoes; then your little kiddies come along; that is what it means to work for a company.

Now, an organisation is a sort of composite person, just as a man is made up of wrist, lungs, fingers, arms, etc. It takes a number of things to make a man. A man is the most complex machine in the world and the most wonderful machine in the world, made by the greatest of all Manufacturers. There is nothing that men have ever made that equals it, and as you will see in a moment *our ideal of organisation must be taken from the organisation of the body and the brain itself.*

An organisation can have disease or it can be healthy. It can have indigestion. You take in 60 new girls; you have indigestion for a while until you get them swallowed and digested. You take in a wrong employee and you find he cannot do his work. It is like swallowing a piece of glass. Never keep an employee you cannot digest. Do not put up with him, because he will give the company a pain, and perhaps seriously injure its health.

A company can have old age. As soon as a company gets that, it does not want anything new. As soon as it gets stiff at the knees, it has old age, and it needs a dose of youth to stimulate it. A company can have melancholia. Place a morbid man at the head of a department and he will discourage everybody until everybody has the blues. A department can have fever, or constipation, or cancer, or the sleeping sickness.

Now the human body is our ideal when we come to organisation, and the body is composed of

specialised parts just as your machines are composed of specialised parts. There is the heart, the wonderful pump which drives it for 70 years or more; it makes 2,649,000,000 strokes in a 70-year life. Then there are the blood corpuscles, little tiny atoms that run up and down the body like motor vehicles, carrying oxygen up and down through the body. There is an automatic thermostat in the body registering the temperature and keeping the temperature normal. There is the eye, the coloured moving-picture show; when you lift the curtain of the eyelid you get the moving picture. All the cinema marvels are right there in the eye.

There is the ear, the original wireless. I am talking wirelessly to you now; the wonders of wireless were known as soon as man began to talk. There is the spine, the original telephone switch-board, with all the nerves connecting all the way down the spine. There is the mystery of digestion, the salivary gland and the teeth doing their work; the starchy matter changing into sugar; the gastric juices; the secretions of the intestines; the spleen doing nobody knows what, and so forth. Thus we find that the body is run by specialists, by specialised parts. It is run by experts if you like; it is run by functions, plus a will. The body is not run on Civil Service lines, else the toe would be the minister of optics, the ear would eat, the teeth would listen, and the hair would walk, and every-

thing would do anything, according to our political method of management.

According to the principles of organisation, you must not have anyone for any place unless he is SKILLED. The body teaches us that "skilled" is the master word, and that everyone must be trained for the particular part he is to play. The ideal of the body is automatic skilled service. The more we can work automatically the better; and we have to continually try to make work automatic instead of having it conscious.

There was a time, for instance, when we learnt to walk. There was a time when we stood up away from our mother's arms and put one little foot forward upon the perilous floor. Then mother told grandmother, and grandmother told it to everybody else—"Baby took a step." It was the biggest thing you had ever done. It was the greatest achievement of your life when you took the first step, because it was the first time you were on your own. It took all the brain you had, and more; and mother had to help you, because you had not brain enough. You fell over the moment you took it. But to-day you walk and never think of walking. Walking became automatic, and that set the brain free to think of other things. Now, that is Nature's method, and it should be the method of every foreman and superintendent.

Organise everything until it becomes as automatic as possible, because that sets the brain

free to think of other things. When you learn to ride a bicycle, you say to yourself, "It is impossible; I cannot pedal and guide the wobbly thing at the same time; somebody must pedal for me while I hold the handle-bars." But by and by you master it. At first it took all your brain and more because you fell off; you had no skill, but you kept at it until you developed the skill. Knowledge and skill made it automatic, so now away you go on the bicycle and you never once think of your legs or hands. You go along automatically, and the brain is free. That is Nature's method of organisation—to build up routine—to standardise as much as possible so that the work can be automatically done.

The body is governed by a three-fold brain—the cerebrum; the cerebellum; and the medullo oblongata. There is a great deal of such knowledge locked up by doctors, and they do not make it generally known. If we could learn it, it would give us much help in this matter of organisation, because the body is the most perfect organisation we know; and we ought to follow Nature as far as possible.

First, there is the cerebrum. That is the centre of will and thought. When I say "I," I mean the cerebrum. If I say "I will go to London to-morrow." that is the cerebrum. If I decide any matter, that is the work of the cerebrum.

Next, there is the cerebellum. It is the superintendent of the conscious work. For instance, if I

say "I will take this chalk and I will draw a design on the blackboard," that is the cerebellum. The part of the brain that guides you when you are thinking as you work, that is the cerebellum.

The third part of the brain is called the medulla oblongata. It is the superintendent of the automatic work. It is the engineer of the body itself—of the unconscious part. It wakes you up in the morning. It regulates your walking. When you are eating, what brings the fork to your mouth? the medulla oblongata. The more you can do automatically the better, because that sets the brain free to think of other things while the body is doing its automatic work.

We have to functionalise as far as possible, just as the body is functionalised. The difference between a jelly-fish and a man is functionalisation. The jelly-fish has not got any legs, mouth, stomach, etc. It is only a little bit of jelly; it is the simplest form of life in the world. There comes a time when a little bit of the jelly-fish hollows in and becomes the mouth, the mouth deepens and becomes the neck, and the neck deepens and becomes the stomach. The mouth was the first function, the neck was the next, the stomach was the next. After that, there came little bits of hard places on the outside of the jelly-fish and they became fins, and so forth. The higher that a living thing climbs, the more functions it develops.

In a human body there are dozens of functions all working together, and if one of them gets out of order the whole machinery is endangered. We never break down completely. One function breaks down, and then the whole body is gone; and organisation means to build up functions that co-operate with each other the same as they do in the body.

It is a safe plan to increase the automatic work until you interfere with initiative, and then stop. There is always too much conscious work in every works. No worker in a factory should be allowed to do his work in his own way, unless he is very highly skilled. Every job must be studied and standardised, if possible, by the foremen.

There is a difference between a rut and a routine—a rut means something that you fell into; but a routine means something that you climb into. You take your department; you construct it; you shape it; you create routine. But if you simply get into a careless habit, that is a rut. Most routine is simply rut and not routine.

When we come to works' organisation, taking the body as an example, it is what we call staff and line. The body is organised on staff and line principles. The will is the line boss and the brain is the staff boss; the brain does the thinking, and the will gives the orders. You have in a large works largely to separate the knowledge from the power—separate the staff from the line—and

functionalise those men who possess the greatest amount of skill. Some workers are functions, just as the lungs are, or the ear or the eyes. The chemist, for instance, is a staff man. He is a function. So is an architect, or an engineer or an inventor.

In line organisation, the rule is that no man should report to more than one man. You can only have one boss when it comes to authority. If any man has to report to two men, he is demoralised. As the Bible says : "No man can serve two masters." Here is Tom, he is under a foreman; he does not go any higher up than the foreman, otherwise there will be trouble. The foreman reports to the Head of his department; he does not report to the Works Manager.

At one time I had the privilege for several months of working in the office of the general manager of a large company in New York; and as I watched him at his work, the one thing that struck me the most was that he seemed to never do anything. The higher up you are the less detail work you do, and the less you do the better. The higher up you get, the less you meddle with the day's work. You must work through the organisation, otherwise there is confusion and disorganisation.

You have got to respect a man if you put him in a position. If eventually he does not make good you have got to transfer him or let him go, but

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while he is in the position, he is in it, and you must not jump over his head either way. You must not play leap frog. The authority must move up step by step. That is line organisation.

Staff organisation is quite different. It is a matter of knowledge and skill, not authority. The best man on belts in the whole works may be a workman in the rank and file. So we put together all who have a special skill and we build up in this way a WORKS' BRAIN. Any workman may become so great a specialist that he will be called into the Managing Director's Office to advise the Board of Directors on the thing that he knows the most about.

We should draw a line right here between knowledge and authority. The commonest mistake that you and I make, as company officers, is to act without accurate knowledge, simply because we have the power to do so. Authority does not mean knowledge at all; and here is the greatest danger that comes to us as soon as we are in a place of authority—we think that we have had a great accession to our KNOWLEDGE, just because we have been lifted up. We have not. A foreman is like a bee, he is always biggest when he is first hatched; and many of us remember the way we spent the first day as foremen. We thought we were wonderful creatures, but our wives knew that we were just the same as ever we were; they knew we were not chemically changed, but we tried to make

ourselves believe that we were—"presto—change—FOREMEN." Now, what had happened to us was power; that is all, and nothing else in the world. We were just the same as we were yesterday, only we had power; and power does not teach anybody anything. It only puts a terrible responsibility on us not to say we know a thing when we do not.

Most men when they get power stop learning. That is a serious thing. Power is what tests a man. I take a coin and throw it down on a hard counter; it rings clear if it is silver, but it thuds if it is lead. That is what power does to you and me. When we give a man a place of power we test him to see the stuff that is in him. Will he go on learning, or will he begin to swank? Will he be a Kaiser over his 25 men because he has power? Power comes to test whether or not, so far as you can, you are going to be a Kaiser. Too many of us try to be Kaisers. Just as soon as you begin to ill treat power, it may overthrow you. We have to keep the spirit of despotism down because there is too much of it in the whole of us, and we have to learn this great lesson of organisation—AUTHORITY DOES NOT MEAN KNOWLEDGE.

It sometimes happens in a department that you must have a technical man over it. This technical man is not good on discipline. It is a curious fact that the man who studies at night, and by his brains masters the technique—the man who is a lover of books—is not generally good on discipline,

and his men do what they please when his back is turned and sometimes in front of his face. So, sometimes you have to have one man representing the knowledge and another man representing the discipline in that same department.

This sort of staff and line organisation is found in the army. A captain in the British Army is made a specialist on maps; he is only a captain, but he knows more about maps than anybody else in the British Army. He has no power at all, but he has specialised knowledge; and he is called in as a technical expert to show how the maps shall be prepared. In the same way a workman can be at the top in knowledge, and the more men you have at the top in a works, the better it is for everybody. You cannot have too much skill.

You can have two kinds of foremen if you like—line foremen and functional foremen. The latter have no power at all, but are put over a function. They are over a certain kind of work. They are specialists with regard to knowledge, but have no power to tell a man to work or to quit. For instance, you can have the cost clerk, the job clerk, the speed boss, the quality boss. An inspector is a sort of functional foreman. You can have a discipline inspector; you can have an operation boss who studies operations over the whole works and does nothing else. You can have a belting boss, a lubrication boss, a tool boss, a waste boss, a scrap boss. It often pays in many large places to

have a man for scrap, who does nothing else than take charge of the scrap heap. Also, you can have a repair boss, a welfare work boss, a text-book boss—all sorts of functional foremen, each one attending to one particular function, but not having any authority over the men. You may go further still and have a "flying squadron" of adaptable workers, who are moved here and there to relieve the pressure. A flying squadron does not belong to any department, but they belong all over the place; and every morning they get their orders as to what department they are to go into. They follow the pressure. By this means you have skilled men relieving an over-worked department, instead of having "green men" coming in from outside.

Another important matter is a system of understudies. When a regiment goes out to fight, if the Colonel is killed, what happens to the regiment? It goes on; the Captain leads—the Captain is killed; another officer takes his place. The regiment still fights on. Every officer may be killed except the Sergeant, but it fights on. There is an understudy for every officer in the army, so that no man is indispensable on the battlefield. It would not do to have an indispensable officer, or as soon as he was killed the army would run.

Every works needs such a system of understudies. I have seen in many a works a manager going into fits because he was going to lose one of

his men ; there was no understudy. If we adopt the British Army system we will have someone ready to take his place. Every valuable man should have a man behind him who has been trained to step forward into his place ; so that no matter who falls by the wayside, the organisation will not be broken.

In ordinary line organisation an officer or foreman has two duties—two main duties that come before everything else. He must co-operate with his Head and have his men co-operate with him. That may seem very simple, but it is often forgotten. A foreman's usefulness to the company depends on these two things. If he does not co-operate with his Managing Director he is only 50 per cent. If his men do not co-operate with him, he is "nowt," as they say in Yorkshire. If he does not co-operate with the man above him, and if his men do not co-operate with him, the organisation is gone, because it is the co-operation in an organisation that holds it together, whether it is an army or whether it is a works. Also, he has to co-operate with the other departmental heads, but that is not so important.

The way to get co-operation between departmental heads is to have a conference once a week. In that way a co-operative spirit is built up in an organisation. The main thing always is not star play, but co-operation. It is a curious fact that as a man becomes clever he becomes difficult to organise. The difficulty is to increase the know-

ledge in a company, and yet not to decrease the co-operation. There is a sort of centrifugal tendency—the faster you go round, the more you fly away from the centre unless you watch yourself ; and a man who is not so brilliant, but who works in with his company is a better man for the company than the brilliant man who wants to be a Robinson Crusoe, and who wants his own department with a wall round it. Some men have their departments encircled with barbed wire entanglements and trenches with a notice, “ Keep out, this is mine.”

Now, that is not the organisation spirit. What that man wants is an island, and that is one of the commonest troubles that any organisation has, and there is not an organisation free from it. We are all apt to swank unless we get enough commonsense. The Lord pity the man whose wife flatters him—no word is more valuable than the one spoken by the wife that keeps us humble. When your wife flatters you, you are done. The only way we can live among other people is by remaining sensible and teachable, and always with a sense of humour. The fact is that neither you nor I nor anybody else is very clever. We have not been living for ever. All the things we know are very little indeed ; and in an organisation there is nothing that pays such high dividends as for a man just to know how big he is and how small ; and to know that after all he is only a part of the company, and that the main thing is to get the company point of view.

A man said to me the other day, "I don't want to be a cog." "You had better be a cog," I replied, "than be a bit of metal out on the scrap-heap where you are." There is nothing wrong with a cog. Break one cog and the machine is gone. I would rather be one bolt of a locomotive than the whole of a pick-axe.

The main thing is to know what organisation is. If you put one of your machines together and leave out one piece, it is no use. No one piece can say, "I am the whole machine." So it is with organisation. It is the tying of many men together, each man in his place working with everyone else, all lubricated with humour and common sense, so that they can break jokes and talk freely to one another, not feeling any grudges, nor carrying any spite overnight. When a grudge is two days old it turns into poison. The thing is to work with other people, and to remember that the main thing in organisation is co-operation.

In conclusion, I remember seeing when over in Paris at the Luxembourg Museum a wonderful statue: there was a blind man carrying a cripple on his back. It took two men to make one man—one man had no legs and the other had no eyes; but between them they had eyes and legs. That is a symbol of organisation—you and I are not complete men; there is no complete man in any organisation. We are all fragments; we are only part of the mechanism. It takes a thousand skills all banded

together, and all those skills working together make the company. The main thing is to get the co-operation, to organise, to standardise, to deputise, to functionalise.

No man in a high position should do anything that a man in a lower position can do. Push the work downwards, and only take up that work which is new and difficult and important. Push the routine work down from you ; deputise ; functionalise ; standardise ; plan ; despatch ; and co-ordinate. There is the secret of efficient company organisation. In fact, just as you assemble one of your wonderful machines, so with regard to the human machinery of a company we must assemble every man in his place ; and when every man is in his place, with his own peculiar skill, working in harmony with others, we build up that great organic structure which the whole world knows by the name of *Mather and Platt*.

IV.

PRINCIPLES OF MANAGEMENT.

The lecture will consist of opinions rather than facts, because we are dealing with human nature. Human nature is the most difficult thing that anybody can study, and a factory is two-thirds human nature. It is almost impossible to have any improvement in a large way without the workers' help. You cannot act as though there were no workers there; sometimes we try, and it is always a mistake. You cannot say "*I*" will do so and so; there are other wills beside yours, and you have to think of them.

Every man is a mystery; there are no two men alike. Talk about variables! The variability of your machines is nothing compared to the variability of your people. Whenever a man is made, the pattern is broken; and there is the difficulty. Stephenson said, "The greatest engineering is the engineering of men"; and our main hope of profit to-day is in the management of our people. The main hope of more profit is not in getting higher prices for what we sell, because competition holds us down. It is not in making inventions, because the long history of patent litigation tells us we cannot rely upon patents to

make money. Other men can get the same machines that we have. Machinery is fairly common to different nations. The machinery of all nations is everywhere, so we cannot depend upon "secret" processes and upon our exclusive machinery for our profits. We must depend upon better management—the handling of our people.

I do not mean that the workers must be speeded up. The hope of a greater production is not in putting the thing up to the worker; that is exactly the wrong thing to do. Do not put it up to him—put it up to the Board of Directors. Do not put it low down, put it high up. The usual way to increase the output is to organise a planning department between the customers and the works.

It is in management that our hope of efficiency lies, not in speeding up the individual worker; because it certainly does not mean taking another squeeze out of the poor lemon before you throw the rind away. To drive the worker is a remedy only put forward by stupidity, not by good management. Whenever men do not know how to manage they drive. In their ignorance they rely upon goading and shoving the individual worker. True efficiency is to manage the worker in such a way that you will get more from him with less energy on his part. It is planning his work so that he does more and does not feel it. It means to give him proper conditions—to give every worker a fair chance to do his best.

You do not manage machinery, you operate machinery. You do not manage material, you handle materials. You do not manage money, you get it, you keep it, or you spend it. The only thing you can manage is PEOPLE. Management means handling the human side. Very often a man becomes a foreman because he knows the machinery well; but as soon as he becomes a foreman he has to know something else. He is not really a manager until he can handle the human element, because good management means putting human nature and machines together and increasing the output.

Now, here is the difficulty of handling people. You can handle iron because you know what you have got; but when handling people you do not know what you have got. When a man is made there are no directions written on him. If I had the making of a new world I should have every man made with standardised interchangeable parts, but at present men are not made that way. A man is a bundle of truth and falsehood and sense and nonsense and fairness and prejudice, and what is and what is not, and what he will do, and what he won't do, and what he likes and what he dislikes. He is all sorts of things that he has picked up in his life. Every man has either one of two handles—pride or profit. The better class of man works for pride; the other class works for profit. One man works for the glory of doing his job well, and he is not

thinking of the pay so much; while another man works simply because he is to have his 35s. a week. But you will find that every man, the highest and the lowest, everyone from costermonger to Prime Minister, can be operated by pride or profit. These are the two main springs that drive everybody, so at once we can do away with variables to a certain extent.

Some day we shall study human nature the way a horse-owner studies horse nature. Take the owner of Ormonde—Ormonde in his day was a perfect horse—everything that a horse ought to be. A horse-owner looks down his stalls and asks—“How is Nellie doing? Just look after her feet; she is tender.” He studies her, watches her, sees what she can do, fondles her, gives her good conditions, cares for her, trains her, is patient with her, and proud of her. We do not do that with people, but the horse-owners do it with horses; and that is why we know more about horse nature than we do about human nature.

But we are beginning to develop what I might call the art of *employership*. We are learning that it is a profession to be an employer—to find out how to get the best results from many people.

I would like to mention, before I go any further, that I am not speaking from the point of view of either Labour or Capital, because I do not believe in either, as such, and I do not represent either. I find one as obstructive as the other. In my

business I never had a job yet without being obstructed by the directors and workers both. I cannot tell which is the worst. Both make trouble. Both are often against the works. I have seldom seen a case yet where both were keen; so I come in to represent the works because usually nobody else does. Everybody else represents a department; the directors represent profits; the workers represent wages. Who represents the business? Nobody.

In most cases there are two points of view, and what we are aiming at is to get both united by thinking of the business. If you will only think of the business, the money will be enough for everyone. The main thing is to get the company point of view.

The whole labour question is almost as difficult to discuss as the Irish question, on which nobody ever says a sensible thing. On the labour question everybody has taken sides. We have all been in strikes and labour troubles of some sort, so that it is very difficult for us to come at things fairly.

To begin with, workers are not stained-glass angels; it is all tommy-rot to say they are; neither are they a sort of lower animals; and it is tommy-rot to say they are. Workers are just about as intelligent as anybody else. I have never found that they were less intelligent than directors; directors are intelligent in one way, but not in another. There are different kinds of intelligence. One of the wisest men I ever knew was a grave-

digger, and I learnt from him as much as I did from any man. I used to go and visit him at nights ; he earned about 5s. a day—he had not the knack of making money, but I wish I were as wise as he was.

Making money requires ability ; but it does not create a man's character. A man may be musical, but being musical doesn't decide his character. Many fortunes come and go quite accidentally ; so that we cannot go into the labour question with the idea that we shall come down from a pedestal and condescend to go among the workers and train them. That is the wrong point of view absolutely ; and it is one of the first mistakes we have to get out of the way.

Nobody is always right and nobody is always wrong. No one is always wise. There is wisdom and folly in every rank of life. I have lived among the rich and in the slums ; and I have never found any basic difference as to the wisdom and quality of my neighbours. We must get over our prejudices with regard to other people.

Some labour leaders say that Labour creates all wealth—that is all nonsense. Labour does not create wealth. Why is not Iceland rich? The Icelanders are all workers, and yet they are all poor. Why is not Quebec rich? Why is not Siberia rich? The reason is that they have no capitalists there to invest money. Labour does not create wealth alone ; neither does Capital create wealth alone. What makes wealth is neither Labour nor

Capital. It is *Thought*. It is the designer, the inventor, the organiser, the man who brings men together of various skills. These are the men who create wealth, not the man who has money, and not the man who has Labour; because neither Labour nor Capital create wealth; that is another mistake we have got to get out of the way.

There are several other prejudices that make trouble. Some employers think that the main thing is to cut down wages. The more you cut down wages, the more you cut the nose off your own face. High wages do not mean high labour costs, quite the reverse. In Japan they make locomotives; and they pay one-fifth the wages they do in the Baldwin works in the States; but the Labour cost in the Baldwin works is one-third as much as it is in Japan. To cut down wages does not mean to cut down cost. You can raise wages and lower costs. The men who make Ingersoll watches live in magnificent houses which cost £1,000 to £1,200 apiece. I have seen these houses in Waterbury, and yet these working men with their sons and daughters produce a watch that sells for a few shillings, and which drives out the watches made by the Swiss who get one quarter as much wages. So, we cannot say that high wages mean high cost.

On the other hand, putting in new machinery does not hurt the workers. The workers think it does. The more machinery—the more workers;

and the higher they are paid and the better their job. Yet for 100 years workers have been wrong in opposing labour-saving machinery. Machinery, in the long run, is invariably a benefit to Labour and Capital both. There never was more machinery than there is to-day ; and the wages and conditions of the workers never were better than they are.

There are no class virtues. I have seen rich people who were extravagant, and I have seen poor people who were very saving. Rich and poor, human nature is the same ; and that is what we have to remember when we come to deal with it. There is no blue blood ; there never was. They are finding this out in the trenches—peers and costermongers are shedding the same blood and fighting in the same way. We are gradually finding out that Labour and Capital have come to the place where they are going to bury their ancient prejudices and differences, and discover this first of all facts, that **LABOUR AND CAPITAL ARE NATURAL FRIENDS.**

A London employer was telling me about his business. I asked him—"How do you manage your men?" "Oh," he said, "I let them alone, mostly ; but I raise hell once a month." Well, he got what he raised. I hope that old way has gone for ever. The war ought to drive that out of us ; that is the Prussian way ; that is the way of the Kaiser. Managers have always been too Prussian,

they have not been British enough. They have been too fond of cracking the whip.

If things don't go right in the works, they make another rule, and put it up—"Rule 47." What do the workers do? They go and spit on it. Fines, too, as well as rules, are used by some managers. The company fined the workmen, and next day the workmen fined the company, and the company never knew it. I never knew a case yet where the company fined a worker but that the worker fined the company double, and collected it. It does not pay to build a great factory, to put in thousands of pounds' worth of machinery, and to turn it over to your personal enemies. It does not pay to give expensive machinery to people who hate you. That old way has gone. I have seen the Hindenburg line drawn in factories—the line of frightfulness—blind, stupid, stolid obedience. All such methods belong to the outgrown follies of the past. I trust they are gone for ever.

There are some factories where there is a guillotine at the door to cut men's heads off—"No heads wanted; leave your heads outside with your coats." Some companies do not want human beings; they want things—obedient things. "This is not a factory," they say, "it is a circus, and we have got a few ring-masters who crack the whip when the horses are running around." That is not a factory; it is not a management; all that is driving and ruling. Do you wonder at the suspicion

that is everywhere amongst the rank and file of workers? There is often a very good reason for it. When a man bucks up and tries to do well they cut the rate and turn him into a slacker by pushing him down as soon as he begins to go fast. That has been done so often. We have taken the goodwill out of the factory by that sort of thing, and we have got to get the goodwill back. There are too many workers who ought to wear a badge, "I hate to work, but I need the money." This morning about five o'clock I heard the workmen going to their work, and the clank of their clogs on the pavement as if cavalry were going down the street; and I thought as I listened to them that the sound of the clogs seemed to say, "Damn the job"; "Damn the job." That is the kind of thing we have got to take out of the factory, and it can be taken out. You cannot get the swing and goodwill among people as long as they are damning the job as they go towards it. That is the tragedy of Lancashire—the tragedy of the whole district. We have taken the joy out of labour, and we have made people come to their daily job with a curse in their hearts; and that has got to be taken out.

Slave labour was always a failure; it ruined Greece, Rome, Egypt, Portugal, Spain, and the Southern States. Slave labour never made a nation rich, and it has thrown many nations down; so the nearer you come to slave labour the nearer you come to disaster. It is the firm that always

lifts up its labour, that treats its men as *men*, and keeps human nature *human*—that is the one that goes on well, while the others fail.

I have no doubt that when Mather and Platt shortened their hours many of their competitors, who were working long hours, said “The output will go down”; but it is the other firms that have gone down, and Mather and Platt are prospering. It is always the way that those who take the human way and the right way will get the advantage of it.

Efficiency is against all this way of handling people; it is against all this frightfulness and terrorism; it makes a factory a sort of organised democracy. Efficiency sounds rather hard and cruel, but it is not. Efficiency means a company feeling. It means team play and co-operation. It means that all improvements shall be made in a friendly way, and not forced upon the workers.

We do not speed up the workers, we speed up the works; that is a very different matter. You can speed up machinery because it has no feeling. What is its capacity? What is its speed? Find out its capacity and speed—keep it going as hard as you can, full capacity and full speed, and you do not hurt the machine. The sooner you wear out the machine the better. Most machines are spared too much. The main thing is output and not to consider the feelings of the machine; so you can speed up the machine—you can organise around

it, but that is not speeding up or injuring the individual worker.

The old way of looking at a factory was to consider it as composed of machinery and unskilled workers; but now we are finding out that there is not a single unskilled worker in the whole place. Everything is skilled; that is part of the doctrine that I am trying to explain—*there is no such thing as unskilled labour anywhere*. If there is anyone who thinks there is an unskilled man in this factory let him come and see me and I will find some skill in his job. I have never found one yet. There is nothing that is done but what can be done in a better way. So, instead of degrading workers, efficiency lifts workers up and recognises the fact that even the so-called unskilled workers may have a very high degree of skill.

The next principle is to introduce self-government in a works as far as possible. The British principle is self-government and we are applying it everywhere except in business; why not apply it to manufacturing? We trusted the Boers; why can't you trust your own people? We are getting back what we spent on the Boers—look at the time it took us to get hold of their country and to show them how to run it and make them happier than they were. We took them into the family and they bit and scratched; they did not want it and they fought against it, yet now we have in England General Smuts, fighting for our flag and conquering

German Colonies for us—he and General Botha are two of the most loyal men we have. To-day the Boers have become transformed from the bitterest little enemies we had into friends of the British people—because we trusted them, and gave them self-government and respected their point of view. We did the same for Canada; Canada is self-governed. The Canadian boys are over here. We trusted Australia, too, and told her to go on her own and run her own show. We said—"Raise your taxes. Go on with your public business. Make your debts what you like. Do what you please. Boss your own country. But remember you are in the family—go ahead and stay in the family." We have found out the way to make our Colonies stay in the family is to let them alone and trust them, and so our marvellous Empire has grown up because we have been wiser than any other nation that ever lived in giving independence and self-government to people. That is what makes them loyal.

So, why not British workers as well as Boers? Why not have a workers' mass meeting once in a while? Why leave it to the politicians to have mass meetings of your own workers? Why let outside agitators come in to tell them what to do? They get your people and tell them what they please about manufacturing; tell them about wages; and you put them into the hands of outside people so far as meetings are concerned without any general

attempt to correct that by having general meetings of your own. No wonder that all sorts of opinions are in the works because we allow them to pick up their opinions anywhere. Why not a real union of all the workers and managers of the place? Why not more Works' Committees? Why not ask the workers to help? Before you make a change in the department, why not call together the chief members of that department, tell them what you are going to do and ask them what they think? Much trouble in a works comes from the management making a change and jamming it on the employees without telling them what it is. It is like the trouble that was in a nursery the other day where four little children were playing with the baby. Baby was heard howling his head off; mother went upstairs to see what was the matter, and one of the little girls said, "Oh, mother, we are just trying to put grandma's teeth into baby." Of course the baby made a fuss. In the same way, we often take a plan and we force it into a department, and then we wonder why everybody is against it.

Is it not better to adopt this as a good British principle : that before conditions are changed in any department, you shall call a meeting? Here is what you propose to do: "What do you say, Tom?" and "What do you think, Jack?" That is the best way, and I have seen it work wonders. It is the British way, and it is what I mean by the

management of men. It is treating them as though they all had an interest in the company.

You know you cannot make your people believe you are interested in them unless you *are*. You can say so; but that does not work. The way to manage people is to trust them and to treat them as though they had an interest in the company, and before long you will find that they have. Then, instead of arbitrary orders we will have more team play. It is an arbitrary order without any explanation that starts the trouble so often amongst the rank and file of the workers, and they feel, although they may not say so, that they have a *right* to be consulted in some way with regard to their own work. The workers themselves know the details of the work better than anyone else, and it is often a very good plan to ask them. A company can get a very great deal of help and information from its workers.

To go a little further, every worker has a right to self-respect. If you take away his self-respect and make him feel less than a man, you have injured him as a worker as well as injured him as a man. Let him develop his self-respect; do not break him down; let him give his opinion. Why not?

If a departmental head went into a factory, went down the line and spoke to one of the rank and file—"Joe, that is an interesting operation. I have never seen it before; do it again; you do it quite

well; would you mind showing me?" Joe does it again and his departmental head watches it, and asks him questions about it. Joe never had that happen to him before in any works; he will go home and tell his wife—the first chance he has ever had of telling his wife anything like that, and he carries it as a piece of big news, and he does not mention it until he gets half way through his dinner. When he gets pretty well fed up he wipes his mouth with the back of his hand and says, "Jenny, I am getting on." "Yes!" says Jenny. "The boss stopped and talked to me for the first time to-day; he asked me how I did that job, that No. 76; he asked me about it, and I showed him; he said it was a pretty fine piece of work." That is the happiest night they have had in that little brick cottage for a long time; it has made that little home happy. It has given him self-respect; his wife thinks more of him; there is a little benediction all over the place, and what has done it? Just a couple of minutes of human management. That is all, but it is a great deal. Why not have more of it?

That is what I mean by management of the human nature element. It means respecting the individual worker, treating him as a man and a brother, not as a thing—asking him for his opinion and not treating him as though he did not have one. That is the way a works gets wise—asking for all the brains and getting ideas from everybody just as far as possible.

Goodwill increases output; friendliness increases output. Most troubles in a works are mental. Why do we not realise that? When a horse balks, the balk is in his head, not in his legs. So, whenever there is trouble in a works the trouble is in the head or the heart. It is a feeling or an idea.

Therefore we should introduce honour and merit. We should have a D.S.O. for our own workers, as they do in the army. Here are two great facts of human nature that we have to build on—aristocracy and democracy. We get them both in every works. Aristocracy in the right sense means that one man can make himself abler than another; democracy means that every man should have the same chance; so you have got to have, in a works, aristocracy and democracy both, and you do have them, whether you want to or not. You have got to use these two great principles of human nature in handling people. Introduce honour, because men will do more for honour than they will for money.

Up on the Clyde the workers are getting all sorts of fabulous prices for their labour, while their brothers out at the front are dying for a shilling a day. What is the difference? *Management*. On the Clyde they have no D.S.O. They have only got money, so they go on strike. They have no money in the trenches, but they do not go on strike; they die, and they die gladly for their country. You cannot get men to die for money,

but you can get them to die for honour ; and we have not realised that the common ordinary men in our works are heroes in disguise. These men who have gone to the front rushed and carried their hearts right on to the bayonet and the shrapnel ; but when they were working here you did not think much of them. Now you have got their names up, but you did not give them a chance to be heroes. You treated them just like common things, and suddenly they enlisted and became patriots. Bob Smith was a hero in Flanders ; but why could you not appreciate him while he was here ? Why cannot we in our works introduce some sort of honour and merit and reward so that our workers will be glad to do their best ?

A short time before Kitchener went on his last voyage, he was speaking to a young fellow who had just won the V.C. ; he put his arm around him and said, " My man, I am proud of you." That young fellow will never forget that as long as he lives ; it will be handed down to his children and his children's children. It is above every reward that earth can give—" I am proud of you." That is what makes soldiers willing to die ; that is what makes them fight ; that is what makes them heroes. It is not that they are paid ; but that the element of honour is introduced ; that is why they do so much.

Here is a runaway horse tearing down the street ; there are fifty men walking along—they do not

move; but there is a policeman at the top of the street; he rushes and stops the horse and he gets one leg broken; but was he braver than anyone else? No, he was not, but he had brass buttons on. Take the brass buttons off and he will run as fast as anyone. A policeman in plain clothes is often the first man to run, because he has not got his uniform on. Courage goes with uniform; it spurs men up; it appeals to what is best in them. The policeman runs in front of the horse because honour is introduced into his task.

Is it possible to introduce honour into a works? That is the problem and it can be done. Napoleon—why did he conquer so many kingdoms of Europe? Because he introduced honour and praise; he took private soldiers and made them generals; he established the Legion of Honour and that was what his men fought for. Cromwell did the same thing; he had his Ironsides; no matter what a man was before, he became a brave man when he was one of the Ironsides; they were never defeated; there were only a thousand of them—those Ironsides—but nobody could defeat them. Why? Because Cromwell had drilled them personally and inspired them with a spirit of honour and courage.

Why can't we honour work as well as war? Is it not possible to do that? Are there any men in this company who have served for 20 years? Are they in a Legion of Honour? What is the reward

of faithful service? Is there any? What is the reward for invention? What is there to create ambition? Is it worth while for a man to do his best? That is what you have to think about. If your men are not loyal, why aren't they? They should be. It is up to the management to say whether they are or not. What is done to create loyalty, to create ambition? Is there a method of rewarding the inventive young man? Is he pushed to the front? Is there any regular plan for rewarding loyalty and invention and ambition in the rank and file? Employees are just like soil—you get what you deserve and every trouble you have goes right back to the management.

I am standing here representing the rank and file just now because they do not get a chance to talk to everybody as I have, so I have to represent them whenever I can. Somebody has to talk for the workers, and nothing is more in the interest of directors than to consider their point of view. Cheer your men with appreciation; then steady them with responsibility. I believe in giving a man praise; but as soon as I praise him I make his job heavier, so that he does not get a swelled head. Always keep a man's job a little bigger than he is, and that keeps him humble.

We must not have this idea which so many good Boards of Directors have, that workers are people that you have got to do things for. No such thing. The last thing they want is charity; the last thing

they want is philanthropy. If you go patronising your people, doing things for them, going to a man and saying, "Here is a penny, good man"; they will turn against you; they do not want anything for nothing. The most independent man in the world is the factory worker. Your factory worker is generally a man who is so infernally independent that he cannot work with other people; he has to work alone. The man who works with other people becomes a manager because he co-operates with others, while the sneering, stubborn fellow who is tremendously clever is working by himself on the lathe.

You can work *with* most men, but not *for* them; and just as soon as they begin to see that you are doing things for them and treating them as beneficiaries, they will resent it, and give you no gratitude. Gratitude you will never get. Gratitude is a fish you never catch if you fish for it.

You can handle men when you work *with* them, when you appreciate their point of view, when you take them into your confidence, when you have responsibility placed on them and give them what they really want more than anything else—*real leadership* instead of rulership. There is nothing that workers love so much as being well led; so, to wind up this subject it comes to this—here are the three vital questions that a management has to ask itself:—"Are you getting the full *body* power of your men? Are you getting the full *brain* power

of your men? And are you getting the full *heart* power? Is their feeling on your side or are their hearts set against you? Are you getting their goodwill or are you not?

In a factory "Hearts are trumps," and if I had to choose between body, brain, and heart, I would take heart, because if I could get the heart power of the men I would pretty well get everything else. You can get the body power after a fashion, but if you can only get just a little bit of heart power so that they feel with the job, there will be no lack of output. It is wonderful what will happen to the output and to conditions and everything else when every man begins to supervise himself.

A company can have a brain. It can have a heart, and I will go a bit further than that and say that it *is* quite possible for a company to have a *soul*—to have a spirit. You know that marvellous old passage in the Bible where it tells how God made Adam first physically. At first he was only physical; he was only clay. But to make him *man* God breathed into him the breath of life, and he became a living soul.

Now I should say the very climax of management is to first work your body power up to brain power, up to heart power, and then develop such a spirit of team play and mutual confidence, one working with the other, that it would be just as if God had breathed into the company a *living soul*.

V.

PLANNING.

In the first lecture we took up the general question as to whether or not it was possible for an outside man to come in and say anything useful. The next thing was to take up the general principle of Efficiency and show what that was—not to go by opinions, but to go by the facts. A man's opinion is a very small matter, and what is called scientific method means to go and find your facts before you make up your mind. Then we took up the matter of organisation and found that the laws of organisation are the same as those of the human body, and that we should try to function-alise, deputise, and push the responsibility down, and do as much automatically as possible. In the fourth lecture we took up the matter of human nature to show that this Efficiency is not a brutal thing, not a heartless thing—not to make life harder for anyone, but easier.

All these subjects, you see, were general principles; there was not much controversy about them and we could all agree; but now I trust you will realise this—as soon as we come to *practical details* we shall disagree; that is why we had to begin on general principles. In every matter of

change or improvement we have to begin where we can agree. You will find, as a foreman, that if you have any difficulty with any men, the way to handle them is to agree with them first, to put yourself in touch with them first; and then by degrees show them where you differ from them. Link on to them first and bring in the differences afterwards.

We can all agree that two and two make four; we can all agree that a straight line is the shortest distance between two given points; but if I come down and apply that principle to your department and say a straight line is the nearest distance between two points and put it down on your floor, you will disagree; you will say: "This fellow likes to go round." When you find you have not got straight lines, you will say—"Oh, yes, but we have to be crooked in this department," whereas you have not. Whenever any principle is applied to a man's own department there is a difference of opinion. The nearer we come to applying these general principles, the more difficult it will be; because we are all more or less of the opinion that what we have been doing in the past is right. I am not saying it is not, but this belief often prevents us from making many changes which we ought to make.

Our subject in this lecture is "*Planning.*" That is one of the principles of efficiency—one of the most important principles; and it can be applied in two ways—personal planning and company

planning. You can make your own personal plans, and then you can have the company's plans, which is a different thing. I would say that the best way to begin planning, the easiest, simplest, cheapest, and shortest way is to put down to-morrow three things on a sheet of paper (put them down to-night) and say, "I will do these three things to-morrow." To-morrow finish these three things and strike them off; that is planning successfully. If three are too many, try one; put down one definite thing which you want to finish off to-morrow. The plague of all our working lives is the number of things that do not get finished; and no job is settled until you clear it off; it is only when a thing is shipped that it is done—sometimes it is not done then.

The easiest way to begin planning is to keep what I call a "*To-morrow Book*," and every night put down one thing, or two, or three—never more than ten, but from one to ten—things that you will *finish* to-morrow. They may be very trivial things, but finish them and strike them off; and measure your efficiency in planning by the way you can do the things you said you would do—"I said I would do three things; I have done three things"—that is success. Go from one to two, from two to three, until by and by put down more. That is developing the planning habit, which is one of the best habits that any manager or foreman can have. If you cannot do that, you cannot plan at all.

I remember asking Mr. Chalmers—now the

owner of the great Chalmers Factory, making motors—if he had any general rules. I knew he had climbed up from the lowest rung of the ladder; he began as a boy, worked up to be sales manager, and did what very few sales managers can do, became works' manager and a very successful proprietor of the Chalmers Motor Co. I asked him if he had any general rule that had helped him through life. He said, "Yes, I have—I have one little bit of a rule but it does not amount to much—a man gave it to me when I was a young fellow, and it has greatly helped me—every night I write down ten things that I will do to-morrow, and to-morrow I do them. That is the only rule that I have ever adopted and held on to, and in that way I have never lost a day."

We do not suffer so much in this country from a sort of mental disease they have in Southern countries—in Spain, Mexico, and all Latin countries—that is, "*manana*," which means "to-morrow"—"oh, *manana*"—to-morrow—we do everything to-morrow; we put everything off until to-morrow. Whatever success we have had in this country has been by using to-day as against to-morrow. Do to-day's work to-day. This is one benefit of a personal plan; it focuses your mind on the job; it prevents you from getting the "*manana*" habit; it prevents you from starting fifteen things and only finishing one; it teaches you to have the cleaning-up habit.

Some of us, sometimes, are like the firefly—the lightning-bug :—

“ The lightning-bug is brilliant; but it hasn’t any mind;

It rambles through the forest with its head-light on behind.”

There are a good many managers very much like that. As we get old we are all like that. I find myself telling myself what grand things I did when I was young, now that I am getting old and grey. When you have your headlight on behind, when you are thinking about the glorious things you did, which are largely mythical, and not thinking of to-day’s job, turning the searchlight of your brain on what you have to do right now, you are apt to waste the opportunities of to-day.

The difficulty is that we start the morning like this—here is a nice, clean, white day, for instance (illustrated by a piece of paper), a clean white day of eight hours; and we begin to fritter it away—11 o’clock—lunch—come back from lunch—rush about—then tea—rush about again—time to go home—and there goes the day. What did you really *do*? Hours and minutes scattered all over the place—nothing definite all day long—looking here, looking there, no decision, no constructive work, nothing done, nothing finished off, wondering, wandering, tearing off, tearing off. Now that is the reverse of planning; that is the catastrophe of many a day; and that is what prevents personal

success, company success, and every sort of success. It is the habit of tearing up of the day, shredding it up, until presently the whole day is gone and you cannot look back and say, "I have done this new thing." You forget that every day is a new day. You wake up on Monday morning—"Here is Monday back again, the same old Monday"—yet it is not the same old Monday. It is a new Monday. This is why you need to have a definite plan, because a whole day can be frittered away, moment by moment, hour by hour. Nothing has been accomplished; everything has just blown away. You can either prepare for things or you can let things hit you.

Science means getting ready for things and knowing ahead. If I had one wish I would say, "Let me know three minutes ahead what the prices will be on the Stock Exchange"—only three minutes and I would soon be one of the richest men in England. That is the value of knowing ahead. I would sooner know one minute ahead than a year behind, because I would then have some knowledge that no one else had. The scientist can tell you the date of the next eclipse; he can tell you when a storm is coming. Our most valuable knowledge is knowing ahead. You men who have control of your departments, who have been in them for five, six, or twelve years—if you have such a grip of your department that you can tell what will happen to-morrow, you have got a wonderful knowledge

which any new man coming in could not have—knowing ahead. So that is why we want to plan, to arrange what we can for to-morrow, instead of waiting for things to happen.

Many of us are like a man sitting in a dark room—somebody comes in and strikes him on one side of the head—“Who has hit me?” He chases about the room, then sits down again and waits. Somebody hits him again, and again he jumps up and runs around. We are often that way at our work; we go and stand at our desk and say, “No trouble; I will just wait for it.” We wait to be hit, and the result is that we are always behind instead of getting ahead; instead of pushing things, they are pushing us.

Last Saturday I saw a crowd of boys from 12 to 13; they were playing football—a whole mob of boys, 40 or 50, all chasing the ball; the only thing they did was to try to kick the ball anywhere. All of them were chasing up and down; no one staying in his place; every boy running his bally legs off; no team play; just chasing the ball. I have seen that in factories—*chasing the ball*. There is no plan, but the managers and the foremen are chasing up and down wherever the ball goes. That is the reverse of planning, simply letting the work go here and there wherever it can, instead of planning it ahead and making up our minds what we are going to do.

You plan four things; well, you get three done—all right. You have 75 per cent. efficiency that

day; carry one over to to-morrow and do it to-morrow. Mind you, without any planning we do get things done; but we never get as much done as we would if we put down definitely a few things and definitely marked them off; there is nothing so good as written instructions. Why cannot a man be his own foreman? Sometimes he does not think of that. Be your own foreman; write out your job; be your own boss; say to yourself—"I will do four things to-morrow." That is personal planning —when a man becomes the foreman of himself and governs his own time as far as he can and finishes his own jobs off. Then he has not been unprepared; he has decided what he will do, and so far as possible he has carried out his plan.

Now as to *works planning*, as to building up what you might call a "*Planning Department*" for a works, it is necessary for this reason, that *whatever requires thought delays action*. There is a time to think and there is a time to act; and the time to think is *before* you act, rather than *while* you act; and in-so-far as you have had to "use your cerebellum," as a foreman said here the other evening, to be thinking and working at the same time, you are delaying the work.

A works is a place of action rather than of thought; therefore, we must, so far as we can, do the thinking first; and when you get a large organisation of 2,000 to 3,000 people you have to organise in the centre of it a *planning department*,

which tries to see how much of the thinking can be done first so as not to delay the action. The cause of most delays is that the jobs are not thought out first. I think you will agree with me in this. You start a job too soon and you finish it too late. You can never hurry up any job by starting it too soon. Starting a job too soon does not mean that you are going to get on with it any better than if you started at the proper time. A job is not like a train—you start a train at 8 o'clock instead of 9—it gets in an hour sooner; but if you start a job to-day that is not ready until to-morrow, it will probably be two to three days late; because you have thrown the planning into the works, and created a state of confusion.

Planning prevents orders that are arbitrary; orders that are hasty; orders that are confusing. It makes the company all one company. What is the management for if it does not plan? If every man is put on his own, and every foreman in the whole works is to go chasing the ball, what is the use of organisation?

The science of management is largely planning. It is indispensable in the army, in the navy, on the railroad, and in the factory. We are thinking very much about standardisation; that comes in through planning very largely—standardising men as well as machinery, standardising both the job and the conditions.

You can apply planning to standardising men, or standardising machinery, or standardising material or methods, and so on, always as far as possible separating planning and performance, separating thought and action, making these separate and *not throwing the burden of thought on top of the man who is doing the work.* There is the unfairness of it; that is where the delay comes in; that is where the confusion comes in. It is when thought is put as a burden on top of labour, on top of the foreman or the worker, instead of being taken out of his way—instead of having it thought out first in a Planning Department.

Every large works needs a central committee or clearing house, call it what you like, in touch with all the different departments. Here you have sales, here you have office, here you have foundry. Here you have works, here you have stores; finished goods; warehousing; shipping; everyone of these is separate from every other, and has its own point of view. You cannot let the office run the works from the office point of view, because there is another point of view in the works. To get a complete company point of view you have to have somebody in the *centre*—some people who are linking all departments together. Then, when a job comes in the office does what the office can do and lets it go at that; and the foundry does what the foundry can do and lets it go at that; but some man or committee in the centre must arrange that all

these parts work together; otherwise you have not got a complete company organisation. Before a job is sent into the works the foundry must have its orders, and the foundry has got to do its work by a certain date in order to co-ordinate with the assembling of a job in the works. The foundry must be brought into line; it cannot do what it likes. It is not a separate foundry, it is part of a company. None of the departments are complete, and the difficulty is that each one has got its own point of view and it is trying to act as though it were a separate thing. That is what breaks the Works Manager's heart and the Managing Director's heart; it is the *lack of team play and interworking*.

All factory work is largely a matter of *assembling*, and in an assembling job the main thing is the planning, to bring everything together to the right spot at the right time, otherwise for lack of a horse-shoe nail the horse is lost; for lack of one casting the whole job is delayed.

The planning department is a central department co-operating with the Managing Director, gathering the facts from various departments, and making a complete plan that takes in sales, foundry, and factory all together. It is a sort of central clearing house, so as to build up a company instead of a dozen different departments that are more or less on their own.

What can a planning department do? Let me just mention a few things:—It studies what to make and how much? You are making some things and not making any profit on them; that is always the case with any company. You cannot hope to be so successful and so lucky as to prevent this. One department by itself cannot tell what things should not be made. I think it is a good policy to let your competitor make what you are losing money on. Find out what that is—what is not suited to you. Make only what you are suited for; do not try to make what you are not suited for. You have to draw the line. You can never accept every order. To know what to refuse is a very necessary thing. “We are very sorry; you had better ask our friends in Birmingham; they can make it for you.” Turn it away. You have not got the knack of making some things you have been trying to make; you cannot make them to advantage, and so you should let somebody else make them. You make what you *can* make, which is the secret of profit; do what you *can* do; do not try to be doing all the time some new-fashioned thing for the sake of taking the order and obliging the customer.

Someone in the centre, knowing all the costs, should decide what orders will not be taken and what to make and so forth. He will keep track of sales and production; check requirements against stock of materials so as to know what to buy;

maintain a stores' system, a proper stores' system with nothing going out except by requisition; analyse jobs as to materials and time required; issue absolutely definite orders for everything to machines and gangs, taking that burden so far as possible off the foremen; get foundry and works, sales and works, linked all together; prevent congestion as far as possible; and study all conditions that interfere with planning.

The tragedy of a plan is that it gets broken up; of course it gets broken up at times. Are you not going to have one because of this? We do not commit suicide because we have influenza. Because you have toothache you do not have all your teeth out. Neither should you say—"There goes the plan; give us back the same old chaos—never mind the plan."

The only way we can get along is by insisting on planning and finding out what breaks it up and prevents that. You do not want to smash your plan up; you want to stop the thing that is breaking it up. Then, after a brief period of experiment you will find that the plan moves along quite well without being broken up.

It is only when you co-ordinate all the departments that you can fix the time for deliveries. The salesman should not decide on the delivery date. To predict the time of deliveries is a very difficult thing to do; it is delivery that makes your reputation and tells whether you tell the truth or not

to your customers. It is no small matter. Delivery makes part of the reputation, and a serious part of the reputation of the works to your customers and the world. You say you will deliver on the 17th—you deliver on the 27th; well, there was a broken date. You cannot treat it lightly. It may be a trade condition. It may be that other firms are making these bogus promises, but at any rate if *you* do that, let the customer know it is a joke. If your time of delivery is a joke, for Heaven's sake say so and say it yourselves. Do not make the works tell a lie; it is a serious matter; it is a matter of works' morality. It is a good works that tells the truth—you can believe it—you can depend on it. A works can have morality; it can have its own ten commandments; and the first commandment of a works is "*Thou shalt keep deliveries.*"

The important thing is to be able to predict deliveries, which no one department can do. There must be a knowledge of all the conditions involved; that can only be obtained by some central planning department that can know all the conditions and decide upon a reasonable date. All orders come in from the outside to the planning department first; so that you say first of all, "Have we got the materials?" At once you send to the stores and find if we have got the materials on hand; if we have not got it we send a note to the buyer, "Order so and so for such a date."

Everything is first assembled, and no order is

released until you find out whether every piece can be made, is on hand, or can be bought by a specified time. As long as you are held up for lack of materials, there is no use trying to make a date yourself; and when you have all outside dates arranged then you can make your own date and commence the job.

The nature of a planning department is that no work is to be started without a written order from the planning department, which does not issue the order until it knows the situation, and can tell whether the various parts can be assembled or not. So you see what it does; it gives you a central control instead of no central control; it gives fair play to everyone in the works instead of muddling confusion.

There is no use making a foreman responsible for things that he cannot help, and there is the tragedy of most works—the thing is put up to the foreman, and the foreman has not the power to do what he is supposed to do. If a man is asked to do a thing you ought to give him the power to do it; so I say this, if you do not want to have a planning department give each foreman the power to buy. Make every foreman a buyer; give him a buying department of his own; give him power over the foundry; give him one of those secret seals that Scotland Yard has, so that he can show it at the foundry and make the head of the foundry obey

him. *Either take the planning off the foreman or give the foreman the power to plan for himself.*

You have got to have it one way or the other; you cannot dodge it; because you must go either way. It leads nowhere to put responsibility on a man and say, "It is up to you—we have promised this for the 17th—go ahead." The foreman has no power at all to finish the job in time; but he is held responsible for that delivery date. The order has been given him and he has not the power to buy; he has not the power over the foundry; and all he can do is to run up and down and beg—"Tom, you know what I did for you last week; do me a favour—go ahead; let me have this casting by to-morrow noon." What is the use of that? That is child's play. That is not manufacturing; it is not common sense; it is not efficiency. It is only a mess and a muddle. It is only something that has not been properly arranged, and you cannot excuse it. If you are going to place a foreman on his own, give him his own cash box; give him his own book-keeper; let him go ahead and finance himself, and you will have a dozen companies instead of one.

But the best way is to have a central department in charge of all central matters, so that every matter that concerns various departments can be handled by a department which has the power and the money to go ahead and get what it needs. In this way you have proper planning, for the reason that a planning department makes the works a

mechanism; it means interworking instead of having different departments run separately by distracted foremen.

It is a foresight department. You know what they have on Atlantic Liners and on railroad systems—two of the finest cases of organisation. Whenever I go on a liner I always study the organisation, and it fairly leaves you gasping that men can do on the sea what we lubbers on land cannot do. Look at a liner—she sails out into the ocean, and she is at least five days from land. She has got to think of everything she will need for five days. She carries 2,000 to 3,000 people. All the people in this company can be put on the Aquitania, and they will be out in mid-ocean hundreds of miles from a shop for five or six days; and they have got to provision themselves for ten days in case they should have any trouble. If they have forgotten the salt they have to go without salt; if they have forgotten the butter they have to go without butter. But they never put back, and they never forget. They have everything. They think in advance, and they plan for ten days ahead for 3,000 people. They plan for every storm and for every possibility. They think of every sort of thing—that is the *Foresight Department* of an Atlantic Liner. If that can be done on a ship, cannot we do more than we have been doing with regard to a factory on land? If we had a factory afloat in the water for ten days, we would be compelled to plan.

The Planning Department is the *To-morrow* Department. All other departments have not got to think of to-morrow as much as they have of to-day. They are to-day departments; but the Planning Department is the "To-morrow Department"—next week—next month—looking ahead—foreseeing—planning the next job—preparing for the next job—thinking out everything that has to be thought out for the next job, so that the burden of the next job does not come on the departmental heads. The object is to get everything ready so that nothing is started until it can be carried through.

It is only what is *going on* that should be in the place where the going on is done. You cannot have half a works and half a warehouse; so a Planning Department plans, arranges, sees that every department has what it ought to have, so that there is no waste time and confusion. You must keep departments separate to prevent inter-departmental trouble—keep each one by itself, but all linked together by a central body, and by conferences of the various departmental heads.

Another thing that can be done is to look ahead and as far as possible level the work—prevent sudden rushes and sudden slackness, which is another thing that makes trouble in works. To-day everybody is rushed to death. ✓Everything is clogged up; then, next week, there is not enough work. You pick up a tool and run around with it

so as to make the place look busy. The *valley* and the *peak*; these two things are what make much of the trouble. The valley is where men learn to be lazy; and the peak is where the foremen learn to swear. So either of them makes trouble. You cannot prevent a foreman from swearing when he gets above the swearing line—if he does not swear when he gets above there, well, teach him, because ordinary language is not enough; and down in the valley you have to think of every sort of thing to keep your men from getting into a lazy frame of mind. With a Planning Department you can level up and bring the work only up to the swearing line. A single department cannot prevent clogging or slacking because it has not the power. No one has the power except the Company, the Managing Director, and the Planning Department. There should be a level at which the works should not be crowded any more; too much is enough. On the other hand, there are times when the orders will fall off and no mortal man can prevent it; but so far as possible everything ought to be done to keep the work as level and uniform as possible.

A Planning Department can largely protect a works from rush orders; from the Sales Department; from short runs; and from odds and ends of jobs. The most wonderful planning department that I ever remember seeing was when I went to the Bell Telephone Co., U.S.A., which has a Planning Department that plans for 20 years

ahead. This is the most wonderful planning, I believe, in the whole world of engineering. Telephone equipment underground will last in good condition for 20 years; therefore when they tear up a street to put the wires and conduits down, they want to know how many to use because they do not want to put too many; and if they do not put enough, they will have to tear the street up again. To prevent this, they have a body of five or six engineers—planners—who spend six months or a year studying a city, finding out where it will be likely to grow, how it will develop, where the factories of the future will be, and they make a plan—what they call a “fundamental plan”—of this city for the next 20 years. They say it is better to *study* it than to *guess* at it; and they have already saved millions of pounds by doing this—studying the cities rather than by going round and interviewing a great many men in the city. They say—“Here is a height, that will be residential; here is a piece of land by a canal and a railway line, that is bound to be a factory.”

A Planning Department can be carried a long way. To condense it into a sentence I would say this—it deals with *causes* rather than with *effects*. Most of us waste our time dealing with effects because we cannot get at causes. The more you can deal with causes the better, and the less you will need to deal with effects. Get back to the root of the trouble as far as possible; that is the aim of

a Planning Department. It decides ; it arranges ; it combines ; it co-operates ; it puts together.

The staff of a Planning Department consists of something like this :—

Chief of Planning Department.

Despatch Clerk.

Stock Clerk.

Materials Clerk.

Labour Clerk.

Of course, the Works Manager and the Departmental Heads come in whenever they please. Also, help comes from the chemist, the engineer, the buyer, sales manager, accountant, and others ; it gets help where it can. It is mainly clerical, gathering data, gathering facts ; and its duty is to furnish these facts to the Works Manager, Sales Manager, and Managing Director, so that they can act wisely in releasing orders and in planning work.

Sometimes it is said that we have too many non-producers. Now, what is the matter with most works is that we have not enough. The non-producer often does more than the producer ; he is the man who plans and thinks. We have a wrong idea that a man is not making anything unless he actually has his hands on the job. A foreman who is walking up and down and sizing up the general situation, improving conditions, and not producing, is doing as much as any 10, 20, or 30 of his men, but he is a non-producer ; he is the man who does the most.

I would say that on an average there should be one non-producer to every seven workers. This has been found out by practical engineers to be a very fair ratio. If for every seven workers you have one thinker, one non-producer, you will have the best arrangement. If you have only one non-producer to 20 workers you have too much worker, and you are not making nearly as much. It is the non-producing, managerial element that makes production more than the actual workers do.

A Planning Department is a sort of Works Library, where the data is, where the facts are, where everything is arranged, and it is variable in size in proportion to the size and complexity of the company. It is not red tape; if it becomes red tape then of course it has to be bucked up; everything has got to be bucked up at times. You can get too much of anything—too much of planning or too much system. All the departments must balance one against the other, and the question is, "Have we got all the necessary elements? Do we need a little more planning than we have?" It is not red tape because it means action, not records. It unifies; co-ordinates; creates a *mechanical memory*. The less you have in your memory the better. A memory is a thing to forget with, and no one's memory amounts to very much; there is nothing that is more unreliable than memory. We want to construct a mechanical memory, which relieves the foremen and departmental heads of

carrying in their minds the situation in the whole works.

In a Planning Department there is generally an Operation Control Board—a large Board, which has a peg for every machine and a tape running up and down these pegs so that you can tell at a glance, "This machine is not working"; "This machine is working"; "This is working full time"; "This is working part time." At a glance you can tell that you have seven machines for which you have no work, and you get busy on them at once. You have 21 machines that will finish up their jobs at noon, so you have to take them next. You can keep track of the whole place by having on one board *the machine situation*, that is only, of course, where there is machine work and repetition work.

A Planning Department can be started in a small way by planning one thing, then when everybody is in favour of it and sees that it is a good thing, and when everybody is agreed on it, you can go a little further and plan something else. It is not a good plan to have a Planning Department made complete and pushed on a works at once. That is why there have been a few cases where a works has said, "We have tried the planning system, but it did not work." Sometimes a man tries to swallow a whole bottle of whisky and you pick him up next morning; and sometimes a works tries to swallow a whole Planning Department and you pick it up

the next morning. But you must not blame a good thing for being put in foolishly. A Planning Department, like everything else, has got to begin on common-sense lines, in a way upon which everyone is agreed ; you must not make it fight its way.

I have no doubt we could pass around slips of paper here with 20 things that might be planned, and you could mark on these slips what you are in favour of and what you are not, and out of 20 you will find there will be seven or eight that nearly everyone would be against and would say "No" ; but there will be five or six out of that 20 that every man will agree to. Begin on the five or six, and when you have got them planned, pass around the slips again with another 20 on, and you will find there are seven you agree upon, and you go ahead with your seven. That is a sensible way to put in a Planning Department. We should not thrust it on the men before they understand it or when they do not want it. It should come in the natural way, asking the managerial force, asking all those who are in responsible positions what they are in favour of, instead of forcing it upon them.

Begin on very small things and work to something larger. In short, a Planning Department means this—to give the works a fair chance, to give it real management. Do not mess it up ; give it proper orders. Give it good conditions ; plan it as far as you can, so as to take the burden of planning, of thought, off the foremen and the men who are doing the work.

Does the planning ever break down? It *does*; and so does civilisation. So will you; so will I; but we are not going to break down if we can help it. The finer a man is, the easier he loses his nerve; the more highly-organised man has to be more careful of himself, and so with regard to a works; but that should not prevent us from putting in as fine an organisation as we can maintain, stopping short of the danger point.

Every mechanism breaks down. You are making electrical machinery; does it break down? Of course it does. Sometimes it runs a long time; but you never turned a machine out in your lives that did not break down. I have heard of a Mather and Platt Dynamo running for 30 years, so that is in your favour. Whenever you send out a machine you know it will break down sometime, so what is the use of objecting to planning? A Planning Department will break down at times, but it can run along a long time between the breakdowns, and by studying the breakages you can prevent them to a large extent. In every works we should have as much done as possible *according to mechanical lines—done by an organised system*, because it has been found out over and over again that a Planning Department gives the largest production, in the shortest time, with the least waste and trouble, and at the least possible cost.

VI.

STANDARDISED CONDITIONS.

Standardisation is a great word. It began in this country, but we did not carry it far enough. It began in this country as almost everything did. Almost all basic patents are British. I have never found any basic inventions that were German, except gunpowder and printing. Most basic patents are British—almost all ideas of organisation, development of industry, and efficiency originated in this country; but we only go so far, and we say, “This is far enough”; and then we go out and we walk between the hedges and we watch the roses grow, and someone else comes along and sees what we have done, and says “Why! they have only got that started”; and then they carry it away, and presently we have the whole world saying “Look what they have got in America and in Germany.” But the idea originated here.

The most difficult thing is to create something; the rarest kind of a man is the inventor. You and I go a whole year, and we do not create anything because we have not got the real originating power. Real creative power is the rarest thing that is in a man’s skull; and there has been more of it in this

country than in any other, as the records of invention will show. We get the first, absolutely the first originating thought, and we carry it a little distance and then we leave it alone, and then some other nation comes along and picks it up and appreciates it.

The original loose-leaf ledger was invented here, and an American wandering through Manchester picked it up, and he made it the biggest thing in that line; it was picked up in Manchester 35 years ago, and it is now supposed to be American. Dyes, too, were invented here, but not appreciated, and they were picked up by Germany and developed by them. So with farming machinery—the first reapers were invented in this country, but the perfected type was American.

In this matter of standardised conditions, we were the first to start a factory system, but we did not carry it as far as we might; and we have now got to perfect our companies and our works in a great many respects. Bad working conditions cause discontent, low output, and all sorts of trouble.

When a man is working under bad conditions, it is like walking with peas in his shoes; a pea is a small matter, but put one in each boot and you cannot walk home; you will be crippled. It is the same with regard to works' conditions. To have satisfied workers, to have them comfortable, not to have a little sliver under the thumb or a pea in the

shoe, or some little irritable thing, is very important. Some of the greatest strikes in labour history have been over the smallest matters—over very trifling things.

Workers make bad conditions for themselves if you do not prevent it. Workers have a general impression in their own minds that they do not spoil their own conditions, but they do very frequently. You give them a dining room, and you have to watch what they are doing. You have to keep it in order; you have to attend to the running of the dining room and see that it is run properly and see that they do what they ought to do; otherwise away it goes, and they will make bad conditions in the room that you have given them.

We all make bad conditions for ourselves. A man has a desk—all right—it is a nice clean desk the first day; the second day it is not; the third day it is not fit to be seen; the pigeon holes are full of papers. You can tell whether a man has the ability of decision by looking at his desk. I make it a rule to have two desks so that nobody will catch me; I have one desk for *research*, that is always heaped up—I keep the door locked and I seldom have the room cleaned. It is the only place where I have my own way, and there is a mess because that is my little room of thought where I am working something out. But my other desk down at the office has to be neat because that is the desk of *action*, and so it has to be clean; otherwise there-

is delay and things are being held up. We have to make a difference between research—the things we are looking into, where there has to be a pile or a mess; and the desk of action which has got to be clean—the routine work; otherwise there is trouble. Keep separate the two things.

I remember one time going into the Bell Telephone Co.'s office and seeing Mr. J. J. Carty, who is the founder of telephone engineering, and his desk was heaped up with many matters. I said, "Mr. Carty, that is terrible; don't let things get like that." He said, "Yes, isn't it a tragedy? Do you know, Casson, I often think of that desk; if I only knew a little more or a little less I could clear it off."

Workers will not protect themselves in mines; they will not protect circular saws; they will not protect dangerous belts or wheels; they will not use safety devices when given to them. The only place in the world where they will do this is in Germany; they will not in the States, and they will not in this country. We have no exhibition of safety devices in this country, but in Charlottenburg, Berlin, they have a Museum of Security—a great building, packed with devices for making workers safe and secure; and every Sunday for a year and a half ahead is taken by Trade Unions of working men, who go to this Museum of Security to study how to be safe. They study such devices, for instance,

as painting of dangerous machinery red; protecting circular saws; protecting miners, and so forth.

If you take 100 school children and turn them into a dirty schoolyard with mud everywhere, and then you say to them, "All boys or girls who get dirt on their boots will be punished." What is the use of that? There are bad conditions; that is an unjust thing. You must first clean the yard if they are to have clean boots; and that is the way in a works, there are *general conditions* that have to be established and maintained by the managerial force, because the workers are not responsible for conditions. They will pull conditions down. They will make good conditions bad, and in general they have not the power, or the money, or the will to lift conditions up.

Conditions—that is a very important word. I remember that one time in Toronto an epidemic of typhoid broke out. Doctors came in hundreds into Toronto; they tried to cure the typhoid patients one by one, but as fast as they cured one, five others got ill, and it was a very serious thing. Presently some enterprising fellow went out and found that the water pipe that brought the drinking water into Toronto had a break in it right near the sewer, and the sewer had a break in it at the same place; so the whole city of Toronto was drinking sewage water. They mended the pipe and the typhoid was gone. So, what was the use of saving

typhoid patients one by one as long as the sewage went into the drinking water?

In the same way, we cannot make every man right until we have got the conditions right. While you are making Tom right Bill has fallen down; while you are making Bill right Tom has fallen down. You must have good conditions as well as individual instruction in a works. The question is—can the bad conditions be changed? Yes or No? Well! if they *can* be changed, then change them; if they *cannot* be changed, then adapt your men and yourselves to them. You can do either one or the other; you *must* do either one or the other.

Nature's law is, "*Change or adapt.*" For instance, take a beaver. The beaver wanted deep water; he wanted a dam, but the river ran straight along without a dam. The beaver thought it out and he made his own dam. He changed conditions; he changed the river into a pond, and he went on flourishing; and that is why we have the beaver surviving whilst other animals went out of existence. The beaver survived because he found out how to change conditions. The giraffe, on the other hand, lives on the leaves of trees, and when he cannot find any leaves on the low branches he has to get them from the high branches. He could not make the trees grow shorter, so he lengthened his neck. The beaver did not change himself, he changed the conditions to suit himself; the giraffe

could not change the conditions, so he changed himself. Thus you have either got to be a beaver or a giraffe, or become extinct. No other kind of animal has survived on the face of the earth except the animal that has changed itself to meet conditions or changed conditions to meet itself.

Men have survived because we learned how to throw stones ; the lion, tiger, dog, cannot do it ; we can. We can hit a thing at a distance, which nothing else can do. The wolf has to be on its prey before it can bite it, but somewhere away back in the early days some monkey-man learned to throw a stone and then man began. Then we began to dominate the lower animals. The tiger said, "There is a superior thing ; I will keep away from him," and so everybody was afraid of man who was weaker in the arm, but who could strike a blow from a distance. Every animal and plant that has survived—and millions have gone down—has had to grapple with conditions. You either have to change yourself or else you have to change conditions.

In China, when the roads get bad they strengthen the carts ; there are no roads in China, there are only just gullies, so they strengthen the carts. Here, in England, we make the standardised roads ; the Romans taught us how. We are efficient road makers and we standardise the roads so that you can run along a road with a light frail carriage or a motor with the lightest possible wheels. Why ?

because the road is standardised. You could not run our sort of wheels on Chinese roads ; you must have heavier wheels because the roads are not standardised.

We standardised railroads so that we have the same width of rails. We standardised the water supply, so that every one of us has in our house a running spring, and we do not have to go to the well, as I had when a boy. I had to go three-quarters of a mile, because we had no water system in Western Canada. We have now standardised the water supply so that the water comes with a touch of the thumb and finger, and there is a running spring in every house in Manchester—one of the most marvellous things, which nobody ever thinks of because it is so common.

So with electricity—the tamed lightning on a wire—it is standardised, and that is what civilisation in the long run has meant—*the mastering of circumstances by man*. Man has been the beaver. A great French thinker once said that if all men were to perish off the face of the earth, the beaver would come up; because he is the one constructive thoughtful engineer among animals; and if man were not in the road, the beaver would come up and take his place. Man has been the beaver who constructed. When he did not like a thing he changed it. We have changed so many things that it is a question now as to how far we can go. That great word “*environment*”—a scientific word which

means what you have around you, is being studied by manufacturers.

Take the matter of light in a works. While a black wall throws back only 2 per cent. of the light, a white wall throws back about 80 per cent. A grey or red colour throws back very little—possibly 20 per cent.—but a white wall gives you back 80 per cent. of the light that comes in at the window. It is almost as good as a window.

We can even go further in this matter of light. I have been making some experiments lately on this line, of what I call "*Visibility*." We know what we mean by "*Low Visibility*" in war: we paint our tanks all sorts of odd colours, so that the Germans cannot see the shape. We put our men in khaki, not red; because red is the best thing to shoot at—the poor French, many of them went to their death because of their red trousers. We learned in the Boer War that the very best mark for a Boer was a red coat; so we took off the red, which was the worst possible colour for a soldier. It took us hundreds of years to find it out. We kept the red jackets on our soldiers for generations, making them the very best targets in the world. We used to put guns on a hill; now we hide them down under the hill. We have found out that a hill is the worst place for a gun. We are finding out that visibility means how distinctly you can see a thing. We did not wipe out the German Fleet in the Jutland Battle because of low visibility, which

means that the German ships were the same colour as the fog; and the fog came down on them, and we could not see which was ship and which was fog. Low visibility!

The law of sight is this, as I find it—we see a thing by its edges, and we see it distinctly in proportion to the background. For instance, you can see white against black, but you cannot see black against black. You read black ink on white paper, but if the newspaper were printed with white ink you could not see anything.

That is the law of sight; that is visibility. I have been applying that in several factories with very remarkable results. Take the matter of inspection. I find a man inspecting a dark grey piece of steel against a dark grey table. He cannot see dark grey against dark grey. There is low visibility. I find a beamer who is looking at white threads coming to him through a creel; he is looking on the white thread with white lint on the floor, and he is trying to see white against white; and he lets the bad threads go through, because he cannot see white against white. I changed that in one instance by getting a piece of linoleum 4ft. long by 3ft. wide, black on one side, white on the other—black when he is running white, and white when he is running black. He is doing good work, and now he says, "I am not looking through a tunnel the way I used to."

So in regard to machinery. A man has five points on his machine to look at. All machines are painted black. Why? We never own up to the reason. The reason is that black does not show the dirt. There never was any reason for painting a machine black. Black is hard on the eye; it is the worst colour that anything can be painted. Nature never made many things black; there are no black flowers; what Nature made black she covered up with green; Nature prefers bright colours. The eye was not made for black, otherwise you could see in the dark. Black means that you do not see; black is not a colour; it is only the absence of all colour and the eye was made for colour; so, you see, a thoughtful man asks himself, "Why, in the name of common sense, is all machinery painted black?"

If we had a machine with five levers, could not these be painted five different colours? I can see colour with the side of my eye, but I can only see the shape with the front of my eye. I can see my blotting paper with the corner of my eye, because it is red; it is a different colour from my papers. That is high visibility.

I find that in a corset factory the needle is steel, and the background is glass; the presser-foot is also steel; so the reason why your wife and mine, when they sit at the sewing machine, stretch their necks and screw up their eyes, and why there is so much eye trouble where they use sewing machines,

is because there is low visibility. They are looking at a steel grey needle against a steel grey background—low visibility. There is no proper background, and you cannot see a needle clearly against glass and steel ; so the question is—can we not have a proper background to enable the operator of the machine to see what she is doing ?

You will find that to see distinctly and quickly is a great necessity in all machinery work, and we have never yet applied to our work this law of sight that we see things by their edges and according to the background.

Also, there are such matters as ventilation stores ; so that we have one place to go to and get what we want very easily ; tools ; clogging ; general litter ; and so forth.

Take this one subject of clogging and untidiness. Unless some special method is taken to prevent a factory from clogging it is sure to clog. To-morrow morning just notice the things on the floor that have no business being on the floor—the things that are under the table, the things that are under the machines, the things that are on the window sill. In an orderly works there should be no window sills and there should be no shelves—nothing under the table, nothing on a manufacturing floor except the machinery and the people and tools. Everything else is more or less out of place, and we warehouse the factory and change it into a place of storage instead of a place of manu-

facturing. There is no limit to the accumulation of litter in a factory if it is left alone.

A while ago I was going through a works further North, making a little survey with the owner, and he was wanting to show me, of course, all the fine things. In going round I stopped and pointed at a big paper parcel under a table. I said, "What is this?" He said, "Oh! that does not matter." I said, "What is it? Does it belong to you?" "Yes! it belongs to me. It is nothing at all; it is only some old stuff. I want to show you—." "No! let us stop right here. How long has it been here?" "I do not know. I will call the foreman." The foreman did not know. "Call the manager." The manager did not know. "Call the oldest man in the place," and he called Methuselah, and he did not know. Meanwhile, we had a couple of boys pulling this parcel out; we opened it, and it turned out to be a gas chandelier which would cost, say, about eight guineas; and the old gentleman said it had been put there 20 years ago. It took 15 square feet of space. It was worth eight guineas, and eight guineas at compound interest for 20 years is 16 guineas. Sixteen guineas is the interest on 320 guineas. There were 320 guineas under that table covered in a paper parcel; and we found 3,500 things like that. We got rid of them and got some nice clean money; we got the place cleaned up and the effect that it had on the firm was wonderful.

If a man is standing in a mess he is in a mess himself; if you have got a man with litter around him you have litter inside him. The conditions outside of a man make the conditions inside of a man to a very large extent; and it is a very serious thing—this matter of environment. Improved conditions increase output and profit. It was one of the standing principles of Andrew Carnegie, the steel magnate. He used to say at every annual meeting—"At all costs improve conditions." In two years he spent four million pounds just on conditions and new equipment. At one meeting in 1899 his directors voted £506,000 in thirty minutes for new machinery. At every annual meeting he had several questions to put, and one of them was this, "Well! what shall we throw away?" He used to ask that with great enthusiasm, and he had to have an answer; and he was not satisfied when they said, "Nothing very much." He would say, "What! What!! What!!! We must throw something out; there is something wrong if we are not throwing away old machinery."

The scrap-heap makes a dividend. It is better to have scrap outside than inside.

I know some companies that set aside in depreciation 33½ per cent. on certain machines, because they figure out that in three years there will be a better machine, and they will throw out this machine and put in a better one in three years, whether worn out or not. That may be extravagant

—of course, it would not do as a general rule, but it has been wonderfully successful.

A factory means *standardised power work*; that is what makes it a factory; and you have to run a works according to its nature. A works is not a warehouse; a works is not a laboratory for experiments; a works is not an office; a works is, as far as possible, standardised operations and conditions and materials.

If I take 100 women and I put them into a long building and I give each woman a stove and a bushel of gooseberries and so much sugar, and tell them to make gooseberry jam, that is not a factory; it is only a big kitchen, because every woman is on her own. There is no combination, no co-ordination, no division of labour. Every woman does the whole job, so I have only a large kitchen, I have not a works. There is a great deal of kitchen work in every works; and there is no money made on kitchen work. There is where the losses usually are. Profits are made on standardised work that has been organised.

But if I take twenty women and make them pick the gooseberries; if I take another twenty and make them wash them, prepare the sugar and get ready. If I put fifty of the women at the boiler, and ten at the bottling, then I have a factory; but I would not have a factory if every woman was doing the whole —the cleaning, the boiling, and the jarring herself. That is where a kitchen stops and a factory

begins, as soon as we have the division of labour and the standardised operations.

The fact is that there is no money made in the work of a labourer's hand; the profit is made from the machinery. Nothing is so expensive as human labour, especially what you get cheap. Nothing is so expensive as cheap labour; the only profitable labour is the highly skilled and highly paid. There is no comparison between muscle and coal. What you do by coal power is done cheaply; what we do by hand power we do at a tremendous cost. I take 1lb. of coal in my hand, and there is power enough in that coal to lift me two miles in the air—10,000 feet. Take one ton of coal—it represents five men's energy for one year—five men for 15,000 days—as against that ton of coal. So, you see, a man's strength is nothing compared to the strength of the coal. That is the wonder of coal power; that is what makes factories possible. That coal muscle came to supplant this little flabby muscle of the human arm and body, and so far as possible, everything should be pushed on to the machines. A 24s. a week girl costs the interest on £1,200; you can have £1,200 from the bank if you do not have that girl; so, you see, nothing is more expensive than human labour employed just by itself.

Another question is—is the factory rightly equipped? Suppose I invite seven guests to stay all night and we have only three beds; that is *under-equipment*, that is one sort of trouble.

Suppose a woman goes down to a shop and she meets a very clever salesman, and he sells her a £30 vacuum cleaner, and she only has one small carpet; that is *over-equipment*. We must avoid the handicap of makeshifts—pushing the work uphill for the lack of fitting the equipment to the work.

How can you tell when there is lack of standardisation? I should find out, first, by studying conditions; secondly, by noticing the variations in cost; and thirdly, by following the line of luck; wherever you have got luck in the factory there is no standardisation. Luck is one of the yellow dogs which you have to chase out of every factory. It has no place in a works. A woman says, "I had bad luck with my bread—I did exactly the same thing as before, but I have got bad bread this time." She did not do exactly the same thing. Not being a chemist, she did not analyse her flour; she bought it from a new grocer and she got a different kind of flour. It looked the same, but it was chemically different and she put in the same amount of water and yeast, but it did not come out right. You never do the same thing twice without the same result; otherwise, two and two might not make four. Two and two always make four; three and three always make six. Do it the same way, and you are bound to get the same results.

Look at the records of waste. I find, for instance, in one mill the variation of sliver waste is from 6 per cent. to 14 per cent. What makes the difference? It shows a lack of standardisation, in conditions or in labour or in something else. Other things being equal the difference between six and fourteen shows that the operations are not standardised or the conditions are not standardised.

To get standardised conditions we look at everything and ask if it suits what it is made for. I was in a factory the other day, and I found 31 sorts of trays, carriers, skips, baskets, and one thing and another—and not one of them was made to fit the job. They were all accidental, and these 31 carriers were delaying and messing the work to a remarkable extent, because no one had thought of standardising the carrier to make it fit the job. Girls were lifting heavy baskets, and men were running about with 7lb. weights. We reduced the 31 to a very few, and made each one fit the work. That increased the output. That is what we mean by standardisation.

Here is a door; it was put in accidentally; it was not measured for its purpose; 21 times a day something very broad has to be taken through it, and it takes four men to push it through. Three men are taken off a job to help the trucks through, instead of widening that door. We often have bottle-neck buildings; we have a building built with one door; which is very inconvenient. You can put a door

anywhere you like, and you can close up a door if you do not need it—the fewer doors the better. But have a door where a door is needed; have a partition where a partition is needed; knock out the partition where it is not needed. No building is cast iron; a building is the glove on the hand, and it has got to fit the hand. If it does not suit, shift it—adapt—if you cannot be a beaver, be a giraffe.

When anything is unsatisfactory, it has got to be grappled with in a definite way. Usually it is nobody's business, because everybody is too busy with something else. Why don't managers attend to it? Why don't they? They have no time for it. You have to create a *special committee*, and make it a special matter, or you never accomplish anything at all. It is everybody's business that never gets done in the main.

No factory is finished; every factory is under the heading of "unfinished business"; and so you have to have a special committee, or some one man who is appointed on conditions. I know one factory where they have a man whom they call the "Trouble Shooter," who walks around looking for trouble. He is a man who has eyes like a Red Indian, and who walks about and sees what is wrong. "Is this all right? Is the light right? Do you want this? Is the wall whitewashed? Can you see plainly?" Conditions! Conditions! He notices nothing else but conditions over the whole

place, to see how far conditions are irritating the men, and preventing output and quality.

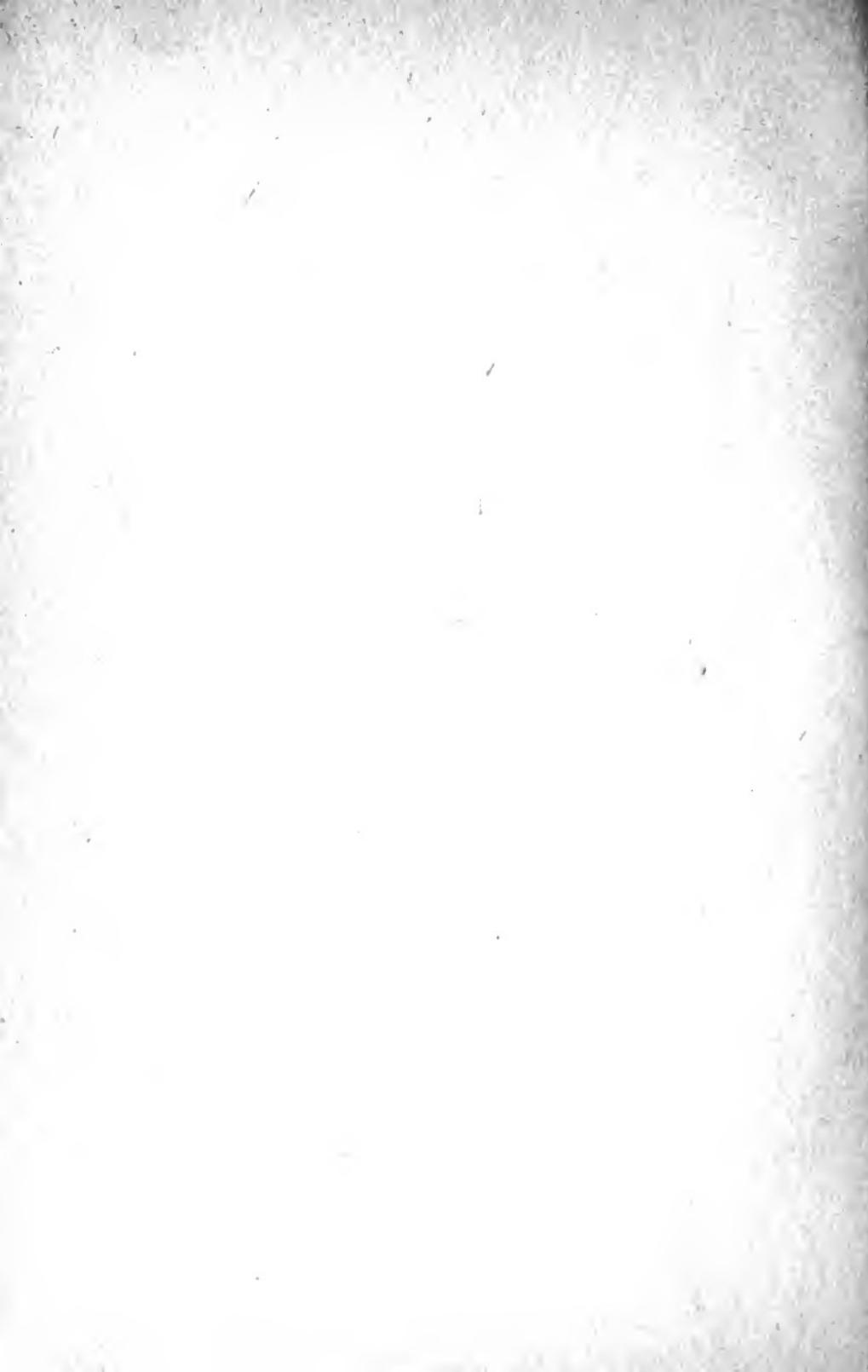
All good management centres on what is unsatisfactory, not on what is satisfactory. We have to be continually looking after those things that have been let alone too long, because they were nobody's business. Lubrication—nobody's business; condition of belts—nobody's business; clogging—nobody's business. All these things are nobody's business; we all have something else to do.

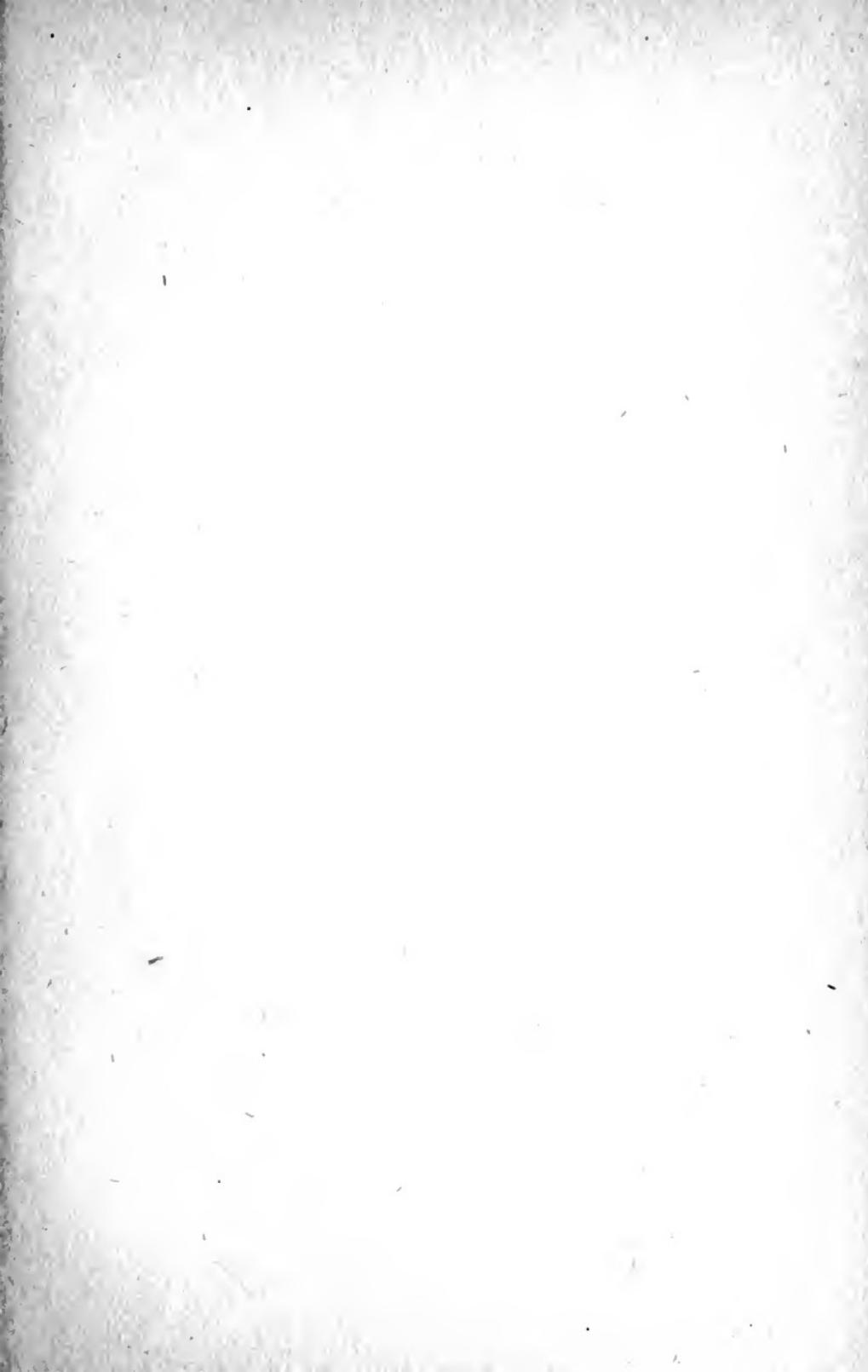
Every factory has its peculiar advantages and disadvantages, and it should make use of its advantages and grapple with its drawbacks. The way you should come round to it in the end is to make a list of disadvantages, of bad conditions, of things that could be made better. One factory where they have had lectures for quite a while has a list of 450 things that everybody forgot, and it is a wonderful thing—that list. That firm is now appointing a skilled committee to get busy grappling with the 450 things. All of them have to do with better conditions and the improvement of the general situation.

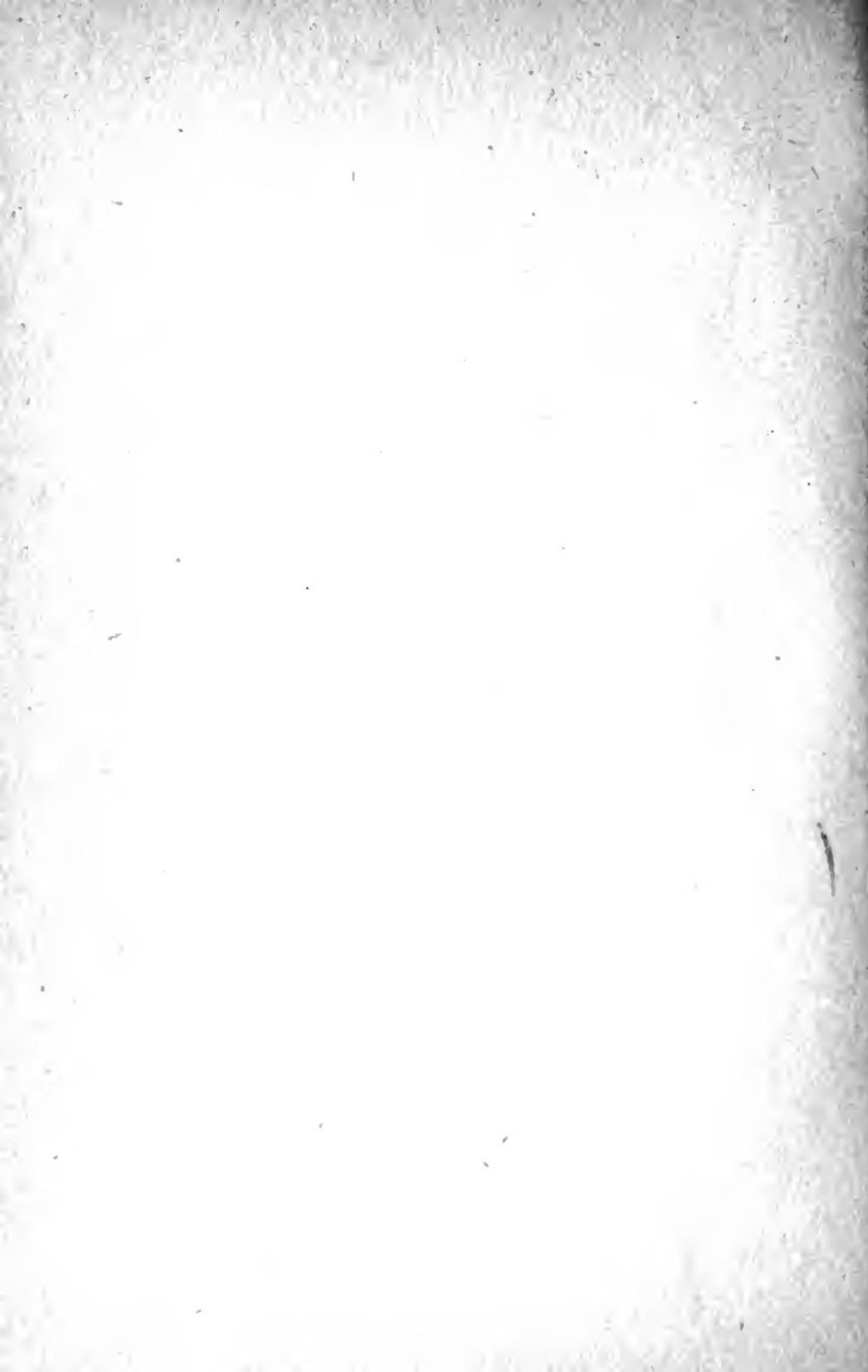
We have to adapt ourselves to conditions, or we have to overcome the conditions. There is no other way. And it just brings us back to this, as all these lectures do in the end, that works efficiency is not a small matter. *Works efficiency is part of man's great struggle upwards.* We have always been grappling with wrong conditions. We

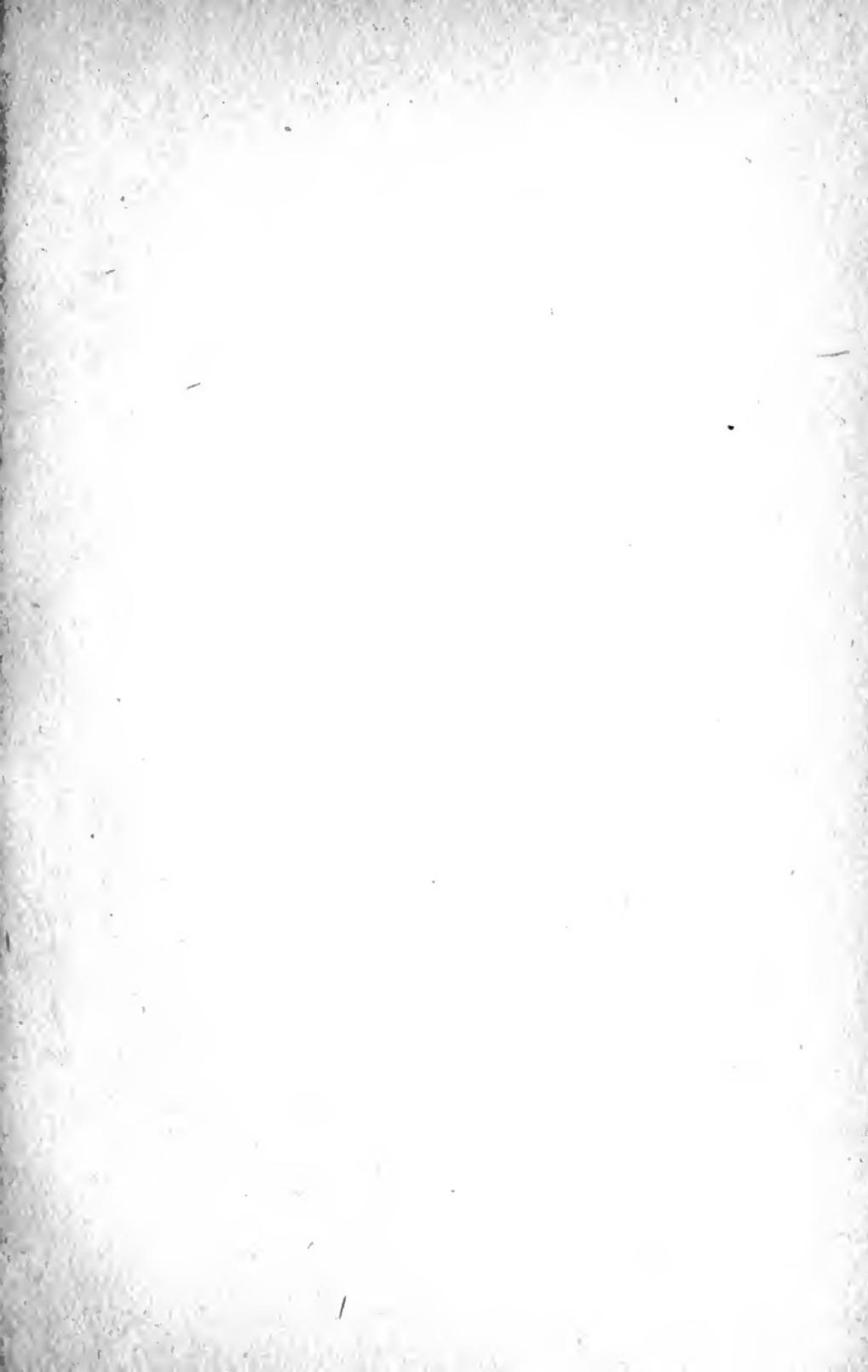
had to find out how to make a house when we lived in caves; we had to find a better kind of clothing than fig leaves; we had to invent tools and machinery and the things of civilisation that are around us; none of them was given to us. When God made us he put within us a brain, and He said to us—"I have given you this; it is enough; go and do the rest for yourselves." The busy bee had his brain ready made; the bird had his brain ready made, so that the tiny little chick just out of the egg shell begins to pick for worms; it does not have to be educated; it has a kind of ready-made brain; but you and I have not. We were dropped in the cradle and there we lay, and we would have died if left alone; we are only alive because other people cared for us; we could not shift for ourselves.

We have no more brain than we use; we have no more intelligence than we exercise; and the problem of life, which is exactly the same as of this works, is to grapple with conditions that are against us and *put them down*. We never had so glorious a chance as we have just now; we never had such bad conditions; we were never making bricks with so little straw as these days. We have every variety of bad conditions. By grappling with these conditions we develop our own brain power; we develop our own characters; *we make ourselves as men by battling with these hostile conditions that are against us in our daily work.*













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